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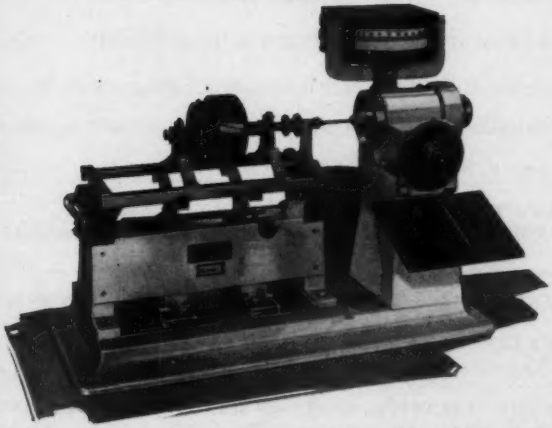

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TABLE OF CONTENTS

Conference Programs. Ivan C. Crawford, Vice President 169
Address. Francis P. Gaines 171
Learning, Morals and Manners. D. S. Kimball 180
Character Building. R. L. Sackett 187
The Drawing Departments' Opportunities in Spiritual Adjustment. Thos. E. French 193
Discussion:
Hale Sutherland 196
Fred E. Ayer 199
C. J. Freund 200
F. C. Caldwell 202
G. H. Shepard 203
L. H. Rittenhouse 204
H. S. Rogers 205
A Glance Toward Culture. C. W. Park 207
Discussion:
Harold W. Bibber 212
W. F. Gerhardt 213
Survey of the Engineering Profession. Isador Lubin 214
New Members 236
Committees, 1936–37 238
Necrology:
James A. Hall 240
William A. Hillebrand 240

F. O. X. McLoughlin 240
Frank H. Neff 241
Alfred M. White 242
The 1936–37 Year Book 243
College Notes 244
Sections and Branches 263
T Square Page 275
English Notes 276
Civil Engineering Division 277
Engineers' Council for Professional Development 279
Report of Conference on Mining and Metallurgy 281
Book Review 283

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240
241
242
243
244
263
275
276
277
279
281
283

Y.

CONFERENCE PROGRAMS

By Ivan C. Crawford

Vice President of the Society; Chairman, Committee on Conferences.

In the September number of the Journal, Dr. Hammond calls attention to and discusses briefly a problem which, although in existence for a number of years, has recently become somewhat acute in Society affairs, namely: How the "diversified activities and interests of the Division and Conference groups may be coordinated so as to avoid undesirable overlapping and conflict." Society members charged with the duty of arranging programs for the groups referred to have experienced a phase of the conflicts and overlapping of which Dr. Hammond writes, and they realize clearly the necessity for some coördination.

This splitting of the membership into groups having certain common interests is a natural process and one which has occurred in practically every national engineering society. It is a sign of vitality and growth. A very real advantage of such "fissuring" lies in the creation of opportunity for a much greater proportion of our membership to become actively engaged in Society work. Active participation in the work of a division or committee stimulates interest, and the result is progress toward our objectives. Also, the smaller groups meet more intimately with the result that individuals really become acquainted and frequently are able to exchange personal experiences in line with the discussions held in meetings.

Creation of a new group—division, conference, or committee—means, however, the scheduling of additional meetings on a program which is always heavily loaded. In the past, programs of annual meetings have been criticized occasionally on the ground that every minute was scheduled, and there was but little opportunity for members to become acquainted, to renew acquaintances, and to visit. Many members hope that we may be able to carry through our meetings with more intervening leisure minutes. Undoubtedly, one of the outstanding characteristics of the Society has been the spirit of camaraderie excercised among members at the annual meeting. General sessions, divisional meetings, and conferences concentrated into a relatively short period of time leave but little opportunity for personal contact.

The Executive Committee of the Society has considered at length the pros and cons of the problem submitted above and has

come to the conclusion that a number of conferences could well be held on the two days preceding the opening of the Annual Meeting. Two summer conferences have requested places on the program at the Cambridge Meeting; one on civil engineering and the other on mechanical engineering. These conferences will be allotted two full days preceding the opening session of the Society which occurs Wednesday morning June 23, 1937, and, in addition, if found necessary, will be allotted one afternoon of the Annual Meeting. By this arrangement, it is hoped that ample time will be given to the summer conferences and some other conferences without undue interference with the general sessions of the Society.

The President of the Society has appointed as members of the Committee on Conferences for 1937, Ivan C. Crawford, Chairman; P. H. Daggett, Vice-Chairman, Rutgers University; P. T. Norton, Virginia Polytechnic Institute; F. L. Plummer, Secretary, Case School of Applied Science; R. L. Sweigert, Georgia School of Technology. Professor Plummer has been designated secretary of the committee, and all matters involving the scheduling programs for divisions and conferences should clear through his office. As everyone knows, the groundwork for a successful program must be laid many months in advance. It is hoped that the program committees for divisions and conferences will, at a very early date, notify Professor Plummer of their time requirements, number of meetings, subject matter, etc., in order that the Committee on Conferences shall be able intelligently to make arrangements for scheduling and space.

ADDRESS *

By FRANCIS P. GAINES

President, Washington and Lee University

I hope that somehow I may sound the theme which your President set for this occasion. It seems wise that your program has gone down to a principle, a principle so universally accepted as the basis of higher education that I suppose no one on earth would dispute it, one that we might accept as an axiom; and even Professor Einstein, who won fame challenging axioms, would probably not disturb this one.

It is stated I think most simply and perhaps in the most straightforward phrasing in a sentence written by James Bryce, and with your permission I shall read that sentence because the second part of it I make my text. "All education has two sides. It means to impart the knowledge, the skill, the habits of diligence and concentration which are needed to insure practical success. It also means to implant taste, to cultivate the imagination, and the emotions."

Concerning the first half of that statement, I suppose there is no demand or opportunity of the practical world that is not helped by such an agency as your own that insures for the institution of higher education a program of reasonable accuracy. But when we enter that second domain, if we accept the dictum that education does have to do with taste and character and emotion and imagination, we are confronted at once with innumerable problems of procedure. One of them has been discussed. The admirable paper of your President sets forth those phases of this kind of education which belong to the inferential and indirect process of extra-curricular activity. I shall confine mine to the academic experiences that may be hoped to make this contribution.

But we are confronted with other problems of procedure. For instance, we do not know how to allocate the separate items of curricula between those two halves. How convenient and how easy it would be for us if we were able to label this course cultural and that course practical and then, having set them up in pigeon holes, establish a ratio and say our program for this instruction will be 66⅔ per cent of this and 33⅓ per cent of that and go home to well deserved rest.

* Presented at the Annual Dinner, S. P. E. E. meeting, University of Wisconsin, June 23–26, 1936.

The directing head of the greatest social agencies of America, the Russell Sage Foundation, in thinking back upon his own college carreer, amazed me, in a private conversation, by saying that he believed the course that had meant most to him was a college course in surveying. Since surveying has nothing in the world to do with his vocation, we have this anomalous situation, that a course which his institution had set up as the most definitely practical course has become, in his case, a course of intense cultural importance. On the other hand, I read in Readers' Digest, as I came to this meeting, a condensation of Dr. Henry C. Link's book, "The Return to Religion." This industrial psychologist tells of a survey made of 10,000 unemployed men and women in New York City in the years 1933 and 1934. He found that those men and women who had definite religious faith were better adapted to secure and to hold jobs in that intensely trying period. I do not mean to turn that statement to an evangelism. I do not think we should secure a very worthy religion if the deans of the schools of engineering should plead with their students that in between hydraulics and highway engineering they might put a course in the New Testament, but from the point of view of education that comment is tremendously important. For here we have religion which is or ought to be, and pray God it will be, the most idealistic of all our concerns and yet it has a very definite job-finding, a demonstrable job-finding and job-filling significance.

Who shall say, then, with confidence which particular courses are cultural and which are practical. And then, of course, we have another problem of procedure, probably a fundamental problem, and that is the transfer of competencies from the academic experience into the great world beyond, the projection into the hugeness of the macrocosm of such fineness as may be achieved in our profession of engineering. For example, I presume if there is one thing that must characterize the engineer it is the nicety of estimate and the probable accuracy of fractions. There is some inherent fineness in his detailed calculations that he must have. Into his professional world he goes and he carries that into building his bridge or in setting up his edifice or in laying the highway. But how can we take that engineer, that same engineer, and give him that same expertness of calculation in the realms of which the Governor talked? How can we teach him the fineness of estimate or the infallibility of applied science in the judgment of human personality or in his estimate of political issues or in his problems of rectitude in his own conduct? How shall he transfer his competencies to those great problems of procedure?

For them I have no easy answer. Indeed, what I may say is trite, but the only answer I know is with regard to the first one,

that every man ought to have enough experiences without an overcrowed curriculum so that at some point in the curriculum this erratic spiritual responsiveness will come forth and spiritual enthusiasms will be stirred. And as to the second one, I know of no answer except that he may have enough of these experiences of accuracy of calculation until they shall seep down from the mental process, and that sanity of judgment shall become a part of all of the habits that go to make up the whole man.

Indeed, if I were speaking at some length of the academic experiences that have to do with spiritual adjustment I should leave the thought of curriculum and say that it ought to be discussed in terms of the larger experiences of the boy or girl on the campus. And in terms of those experiences, let us go back to what James Bryce said. He said something about the imagination, and it is my conviction that every student, regardless of his professional alignment, should have first of all the experience of enrichments of his life. This is the primary cultural obligation of every institution.

Now as one who used to train jockeys for Pegasus let me admit that my side of the educational world has sometimes been foolish and stupid. Culture has nothing to do with the fads of the highbrow, with the arched eyebrow. I do not know, as Popeye would say, anything more disgustable than the college product who comes out and spends his life claiming he is an esoteric shadow. This night we heard somebody say, for example, that Proust is difficult and Proust has no message except for the intellectual; and the student or graduate spends the rest of his life trying to find out what Proust is talking about. He probably does not know but he quotes him bravely anyway. Your profession is not to be discussed in that light way.

Another thing about this primary cultural obligation is that it is a qualitative and not a quantitative matter. My side of the educational world has never liked to admit that. Teachers learn in graduate courses and want to transfer to students the fullness of detail which has been mastered. But it is better for a student to take John Milton's sonnet on his blindness and see those fourteen lines in that spiritualness of the engineer than it is for him to know all the sources of Paradise Lost or even to know the first names of the three ladies whom John Milton married in the stages of his career. One term of history well taught, as the Governor has said, well taught (and it makes no great difference where it comes) will suffice to show the student how things come to pass in the world. One character of fiction or of biography, competently understood, will send that student on the most profitable journey

he will ever take, the vicarious experience of living through another man's life, gaining from that other life the wisdom which, thank God, the student himself does not have to pay for with his own mistakes. One passage from Shakespeare, one passage from the Old Testament, properly taught, will show that student what poetry is, and how the pageant of a dream can pass on this screen of imagination regardless of the external circumstances, and how the meaning of life yields itself to wise minds. It is a qualitative thing, but the obligation is there. And if I might take the words of Lord Bryce in one sentence again, one of three sentences, I would say it is this: that no school has a right to turn loose upon the world a boy or a girl until that school has emboldened and ennobled the imaginative apprehension of that life. It is not merely a matter of broadening taste. Professor James, who said many things well, asserts that every man is but a fraction of himself because of narrow interest. It is not merely a matter of endowing that life with the inner sources of enjoyment that could make him independent of circumstances about him. It is not merely a matter of training him so that he can enjoy the fruits of the finest human labor. It has to do with his spiritual adjustment, that in his imaginative apprehension there is a quality for the high moments, the emotional transfiguration of his life. The evangelists used to say in the good old camp meeting days, "Show me the pictures that hang upon the wall of your imagination and I shall show you what kind of man you are," and by the eternal, they were right.

That is the primary obligation of education. In the early dawn of that day that was to see the Battle of Agincourt King Henry called his little band together and he made that memorable speech you remember. Three lines of it I quote, from what he said to his men, frightened in the face of the enemy:

> "This day is called the feast of Crispian:
> He that outlives this day and comes safe home,
> Will stand a tip-toe when this day is named."

Will stand a tip-toe! But all men stand a tip-toe at some time. Old men, with their memories, yes, but young men with their dreams. And that college boy in the school of engineering, when he is suddenly exalted above himself, when he rises in ecstasy, does he know what it actually means to stand out? When in education he stands a tip-toe, what inspiration shall send him there? When his eyes light with a strange light, peering through impenetrable distances, what does he see? His hands reaching to heaven, yearning, for what are they clutching? And if, as a result of that mo-

ment, life takes a new direction for him, to what point shall he face?

Has engineering education anything to say about that? Has engineering education anything to say about what Lord Bryce says, that it is also the duty of education to minister to the imagination of men?

But there is a second academic experience and that has to do with what Lord Bryce called character. Let us think of that as a fortifying of life. It is not enough to make life rich; we must make life strong. That word has been on every man's tongue, like a well chewed piece of beefsteak that has long since lost whatever flavor it may have had.

What does higher education have to do with character? Well, I do not think it imparts the virtues that the home ought to give or that the church ought to give, but what it does do is this, if I have analyzed it correctly. It seems to me that what higher education can do is to safeguard those virtues, and then to take them one by one and change them from certain negative capacities into positive things.

Take the matter of honesty, which I regard as a basic human virtue. It is not enough that the man must not steal, it is not enough that the man must not lie or cheat in school. All those things that belong to honesty and education ought to protect him. But what is an aggressive and constructive definition of honesty? What do we mean when we say a man does honest work? Do we mean merely the fact that he has not stolen something from somebody beside him, or that he has punched the clock? No. We mean that there is a degree of mastery, that he has been unwilling to quit at a task until that task has elicited from him every capacity. That is the positive, the constructive, definite interpretation of honesty.

Let us pass on to another phase of character. Next to honesty, I think the most important trait in human behavior and human life is self-control, the government of life by a great will. We commonly think of self-control entirely as a strong capacity to resist. Character education, if I know what Lord Bryce means, takes self-control and makes it a positive, dynamic resistless sort of power that projects life forward, instead of holding it still in some immaculate inviolability of resistance. That is where character comes into education, for life, after all, is a sequence of the intoxicating moments and the emotional hangovers.

I remember years ago we had a class in ethics and the professor was talking about character. He kept on talking about character and I had little idea of what he was talking about. Finally one

boy in the front row said, "Do you mind giving a definition of character?" This was a quarter of a century ago. The professor paused and used one sentence that burned itself into my mind so strongly that it has never gone out. He said, "That is a large order on short notice, but I shall give you a definition of character that you may keep until you find a better definition.

"Character," he said, "is an inner force that enables a man to carry out a worthy resolution after the mood in which the worthy resolution was born has passed away."

May I repeat that? "Character," he said, "is an inner force which enables a man to carry out a worthy resolution after the mood in which the worthy resolution was born has passed away."

Life is itself a sequence of intoxicating moments, like that moment of ecstasy that I mentioned; but there may be some great vision, some sense of gratitude, some part of the social problem that the Governor has laid before you. The high moment shows us the landscape, but that moment passes. The echoes of the Governor's eloquence die away. The mood of our resolution effervesces. It is only the man of character who can pick up the purpose he has made and sustain it however much that enthusiasm may sag and falter to the ground.

Does education have anything to say about that? It has a great deal to say about it, and I will tell you where it has to say it. It has to say it in the repetition of strong disciplines that are for the moment disassociated from the professional intentions of a life. Let me repeat that prepositional clause! Disassociated for the moment from the professional intentions of a life. It is a pretty poor character education that gives a man strength of resolution only in an avenue that opens wide some professional ambition or that has on the other end of it a bank account. This thing we call education must give men the power that comes from the tedious repetition of duties performed, for something more worthy than the mere increment of income that may be represented. A mighty will remains only for that man whose purposes can be sustained by some motive that his own mind accepts as noble and that his highest moment has endorsed for him.

Lord Bryce also said something about the emotions. That seems to me to be the highest of all obligations of the academic world. If we can find somehow in this thing we call curriculum an experience that has to do with the emotional commitments or the sympathy of life, we have achieved a great deal.

And by the way, if these somewhat wind-tossed remarks of mine must be accounted for down to the boy's curriculum, let me say that in talking of enrichment of life I was thinking of English and

history and art; and in character formation I was thinking of mathematics and languages and general sciences. And now I am pleading for the largest understanding of the social sciences that our schools can give, not the pedantic and the academic understanding, but the vitalizing of those things in the world with an unforgettable emphasis. It seems to me that here is the problem of the engineer to-day. Shall he be a man of broad sympathy, of broad understanding? I venture to quote one of your own prophets, writing in 1903 a book that seems to me to be of continuing importance. I do not know how many engineers remember it, but as a teacher of English I knew it thirty years ago. George S. Morrison had this to say in that book of his called "The New Epoch," as developed by the manufacture of power, published, I think, in 1903:

> "To training and instruction must be added the spirituality which alone makes men worthy of the power education gives them. Never before have the opportunities for selfishness been so great, whether that selfishness be devoted to acquisition of useless wealth, to indulgence in degrading luxuries, or to general disregard of the rights of others. In communities where everything is organized on this selfish basis of commercial life, these influences may transform the great forces of the new epoch into powers of destruction from which the world will never recover."

I do not mean to say that the condition which Mr. Morrison mentioned in 1903 has come upon us, but I do feel safe to say that in the social order the position of the engineer has been rising steadily until to-day he is in some respects the key man of the new epoch as developed by the manufacture of power. Scientists, engineers, technicians, these, if not the autocrats of our present order, are certainly the pacemakers of society. And their responsibility is very great and the responsibility of those of us who train them is equally great.

It seems to me that the ultimate obligation of the academic experience toward spiritual adjustment is in the realm of sympathy and not concrete sympathy merely, not only the sympathy the foreman might feel for a group of laborers under him, not local sympathy merely, nor sympathy for his own community, but a sympathy so large that it may be as inclusive as the needs of the day.

I do not often find myself in agreement with the philosophy of Mr. Bertrand Russell, but in an essay he wrote on education, which I picked up with some suspicion, I found myself at the conclusion endorsing what he said. Having passed through several stages in his discussion of what education ought to do, more or less platitudes, let us say, he reached the conclusion with what he called the climax

of education. He said that the climax of education, the ultimate achievement of any education, in any field, in any human life, is the capacity for sympathy with the abstract ideal, and his emphasis was upon the word "abstract." Any warm-hearted ordinary human being sympathizes with distress or unhappiness that may be about. Anyone who has local civic patriotism will wish his community to be promoted, but Mr. Russell was talking about the capacity of the educated man to sympathize with the abstract ideal. And I think I shall never forget the illustration that he used. He said that any person in the world, educated or uneducated, who has a member of his family die from cancer, will never forget the terror of that disease. He said that anyone who had that happen will feel it a kind of duty to spend the rest of his life fighting the disease in every way his lay efforts can command. But he said the educated man is the man who can look at a chart and at the network of lines and see one line rising steadily to represent the death rate from cancer and can feel the same tingling horror and the same sensation of revulsion that he would feel if the think struck those closest to the circle of his heart's affection. Transfer that kind of sympathy to any great public ideal, health, yes, economic justice, yes, war and peace, yes—transfer that capacity to any public ideal and you have achieved the climax of all education. And if the academic campus can do that through the experiences in enough men and enough women it will transform the world in which we live.

When I was teaching jockeys how to ride Pegasus I used to undertake to present poetry in as many different ways as I could, and I would sometimes use it as a process of definition. I would have them go to the dictionary and find out what Mr. Webster said about something. I would have the poem there. We studied the difference between the poem and the dictionary definition to see if we could find out anything. I remember a little poem which you all know, the title of which is "The Soldier." I used to ask my boys to find the definition of patriotism. After they had found it and brought it back to me from all the dictionaries they knew, I would read them the poem as a contribution to that understanding of how the poets can interpret. You remember the poem was written by Rupert Brooke; you remember he was a rather happy-go-lucky Englishman who was prosecuting no serious purpose until the war came on. Suddenly he realized that England was in danger, Old England which had been queen of the seas since the days of the Armada, was in danger. He joined her defenders; he was sent to the Dardanelles and served there. Not long before he died he wrote this little poem I adopted as a definition of patriotism. "If I should die, think only this of me," and he did die then; and

I never quote this poem that I don't feel that his voice is speaking, imperfect as the moment's reproduction may be:

"If I should die, think only this of me:
That there's some corner of a foreign field
That is for ever England. There shall be
In that rich earth a richer dust concealed;
A dust whom England bore, shaped, made aware,
Gave, once, her flowers to love, her ways to roam,
A body of England's, breathing English air,
Washed by the rivers, blest by the suns of home.

And think, this heart, all evil shed awar
A pulse in the eternal mind, no less
Gives somewhere back the thoughts by England given;
Her sights and sounds; dreams happy as her day;
And laughter, learnt of friends; and gentleness,
In hearts at peace, under an English heaven."

Patriotism can go no further than that. "When I die," he said, "don't put a little slab there, Rupert Brooke, born and died. Say 'There is a little bit of England,' and if my soul enters the blessedness of the immortal and is clasped to the breast of God and beats there against the everlasting pulse of love, while the chorus of the Redemption sounds in my ears forever, there, against the heart throb of God is a little bit of England."

Patriotism can go no further. The man is lost, his identity ceases in behalf of a great cause that claims him and absorbs him and with which he is identified forever more.

Suppose, in the school of engineering you could put that spirit into the boy? The world would be transformed.

Shall we not think that the spiritual adjustment of his academic experience is incomplete until it makes life rich with the noblest resources of the human fancy, until it makes life strong to sustain the noblest purposes, until it makes life devoted to the noblest causes of our common destiny?

LEARNING, MORALS AND MANNERS

By DEXTER S. KIMBALL

Dean of the College of Engineering, Cornell University

Three factors that influence greatly that elusive thing that we call *character* are *Learning, Morals* and *Manners.* They are not necessarily connected with each other. A man may be learned but have neither morals nor manners; he may have high moral standards without either learning or manners; or he may have elegant manners without learning or morals or he may have any of the possible combinations of the three. All will agree that these are highly desirable qualities in the college graduate. The older English universities with their longer experience and with England's peculiar needs in mind long ago placed learning, morals and manners on the same plane of importance. And a training at these universities or at the so-called public schools such as Eton is, I am told, as much a training in manners as in learning. "In the Ages of Faith, Oxford and Cambridge produced clerics, in the Renaissance scholars and humanists, in modern times capable governors, while the specialist has been a by-product in all periods." Our American universities and particularly the Land-Grant college group with their somewhat limited experience and concerned as they have been primarily with the *economic* problems of a new country have tended to lay greatest stress on learning, to place morals as a secondary consideration and for the most part to let manners fall where they may.

As our country matures we shall, undoubtedly, tend increasingly to follow the procedures of the older seats of learning. There are already many indications in this country that the problem of good manners among university students is to receive much more attention than hitherto. I think this must necessarily be so if we are to achieve desired results. In any case I believe the time has come when the relative value of learning, morals and manners in university life must be given more careful consideration than in the past. And, this may lead to some far-reaching results because as has been noted learning, morals and manners are independent variables and do not necessarily spring from any one phase of instruction. Perhaps the development of morals and manners demands influences and personnel that exist only in rudimentary forms as yet in most college precincts.

On Learning

From time immemorial *learning* and *wisdom* have been considered as synonymous. Just outside my office door there is a large wooden plaque placed there many years ago by Doctor Robert Henry Thurston, the famous Director of Sibley College. On it in gilt letters are some quotations from Solomon: "Wisdom is the principal thing therefore get wisdom; yea with all thou hast gotten get understanding. Take fast hold of instruction; let her not go; keep her for she is thy life." It is interesting to note the range of learning and wisdom open to this wisest of men. It necessarily consisted only of the Hebrew Classics and the inherited knowledge of men and their characteristics that had come down to him from Egypt and Babylonia. Of science he was ignorant except perhaps of some such knowledge as pertained to architecture. And his learning and wisdom were typical of all handicraft civilizations. In such simple civilizations learning and wisdom were no doubt closely connected. They were humanistic in character and science appeared as a silver thread often obscured by ignorance and bigotry.

It is often stated that the modern era began with Francis Bacon (1561–1626) and his great work "Novum Organum" describing the inductive method of reasoning is often quoted to that effect. It is more likely, however, that he was partly a product of his age, as is the case with all reformers, and that the spirit of new methods was already in the air. In any case, the inventions of Watt, Hargreaves, Arkwright, Faraday and other great scientists and engineers have brought us into a new world, where the range and depth of knowledge is so vastly greater than in the days of Solomon as to make comparison useless. And in this vast range there are many kinds of learning and learned men. We still have historians and classicists, but there are also learned scientists, engineers, chemists, physicists, astronomers and what not; and their learning is deep, wide and exact. I am aware that there is a group of organizations concerned primarily with the humanities that have formed what they call "The Learned Societies," but I fear that they greatly flatter themselves for learning is no longer the exclusive property of any group or class. Whether modern learning bestows wisdom upon its possessors may be doubted. Indeed a casual view of our own country gives one the impression of much learning, but little wisdom, otherwise we should be able to see our way more clearly out of the situation in which we now find ourselves and to avoid a repetition of such a calamity in the future. What is it that our modern instruction lacks to confer both learning and wisdom upon its recipients? Specifically what

does engineering education lack that will enable us to graduate men that are wise as well as learned.

My reason for raising this query is as follows. About three years ago the American Engineering Council solicited opinions from engineers all over the country as to the causes and cures of our present depression. As a member of a sub-committee I read a large number of these contributions. Many of them were written by engineers of note and reputation, but their economic ideas were certainly vague, contradictory, often fantastic and certainly many of them are lacking in wisdom. In this general appraisal the committee were unanimously agreed. And it must be confessed that engineers as a group have not impressed themselves upon our social and economic problems in proportion to their knowledge of our industrial life. In this narrowness of wisdom engineers and engineering teachers are not alone. The great growth of knowledge in every field has made it very difficult for all of us to keep up with our specialties to say nothing of related fields and others more remote. Yet apparently this does not prevent us from declaring ourselves on other matters. It was ever thus. An old philosopher, it will be remembered, states that the shoemaker resents any suggestions from others concerning his calling, but in political matters he, like all men, can speak as though he were an oracle. And the situation is more confused when learned men in the fields of, say, law and economics disagree vociferously over principles and policies that they should be able to elucidate to others. Surely we need to read broadly if we are to understand even partially this complex world in which we live.

And it may be that our failure to do so is our greatest weakness. A few months ago I happened to converse with a professor of a liberal arts faculty and inadvertently he stated that he had never read Robinson Crusoe. I was as much astonished as Samuel Pepys when his old friend W. Stankes "could not be wooed by my wife and Ashwell to go to a play, nor to White Hall to see the lions though he was carried in a coach. I never could have thought there had been upon earth a man so little curious in the world as he is." I was on the point of asking my professional friend if he had ever read the twenty-third psalm, but thought it best not to plumb the depths of his ignorance. There should be in every university library a collection of the world's greatest books and so labelled. It would not be a large collection even when the debatable ones are included. And it should be a condition of promotion to a full professorship that the candidate had at least made himself familiar with their contents for "reading maketh a full man."

On Morals

In the matter of teaching morals and religion, American universities and colleges are divided into two groups. One group holds that instruction in morals and religion is essential to university education and makes such instruction obligatory in the curriculum. The other group, while admitting that instruction in this field is desirable, and while making provision for religious worship and for instruction in ethics, leaves it to the student to elect what he desires. In many instances auxiliary organizations such as the Y. M. C. A. find a large place in college life. Thus, Cornell University offers instruction in the history of religion, the philosophy of religion and in ethics. It offers excellent facilities for worship and in addition the Cornell United Religious Work combines the influences of many local churches and religiously minded students in a strong effort to improve the morals of the student body. So far as engineering colleges are concerned the trend appears to be toward the latter group. When engineering was first offered at Cornell in 1868 the curriculum included a course in "moral philosophy" but it was long ago excluded in favor of more mundane studies. And I suspect that the majority of the larger universities will depend in the future upon the home, the church and such university agencies as I have mentioned for training in morals reinforced by the fear of expulsion when the breach of the moral code is too great. It is difficult to estimate whether we have or have not made progress in this regard. Personally, I believe that the student of to-day is, on the whole, better morally than those I knew in my student days and in my early teaching years. And when one sees the old grads at reunion times or hears them tell of their own college days, it would appear superficially, at least, that we have made some progress. The university after all reflects quite accurately the general state of morals and of home life and there are distinct limitations to its ability to change the picture during the student's college days. In any case I fear there is little we can do except as individuals to raise the general level of student morals. Where colleges are in small towns, much can be done to keep the surroundings wholesome, but in a large city bad conditions are difficult to combat.

On Manners

The problem of good manners is somewhat different. Here, I believe, there has been a distinct decadence and student manners are not as good as they were. I am aware that it is quite usual to speak of the social customs of forty years ago with amused tolerance. But men of my years will insist that the social life of

those days possessed a dignity, courtesy, and elegance that the modern student world might try to recapture with profit to itself. The difference is so marked in so many ways. A few weeks ago I heard that great orchestra in the Radio Music Hall render Strauss' "Tales from the Vienna Woods" and it was to me reminiscent of certain social niceties that are no more. The next night in Ithaca I heard a modern jazz orchestra hammering out the jungle tom-tom discords that the modern student classifies as dance music. I confess that I cannot bring myself to believe that the distance between the two performances measures social progress.

I am always disturbed when a freshman comes into my office with his little cap on his head and a cigarette in his mouth. I am distressed when he reappears as a senior, hat on head and pipe in mouth, having made no progress in good manners, but like Omar of old coming "out the selfsame door wherein he went." Much of our campus automobile trouble is caused by simple bad student manners and the utter disregard of the sensitiveness of some older people to tobacco on the part of students of both sexes betokens thoughtlessness at least. In my opinion, also, the much greater freedom between the sexes has tended to break down certain niceties of good manners, though probably it does not indicate lowered moral standards.

I have lived in frontier towns and have seen social life at low levels. I saw San Francisco's Barbary Coast and New York's Bowery when they were in their prime and cannot therefore be accused of being uninformed or unsophisticated. And yet because of these experiences or in spite of them the sight of a young woman sitting at a bar lapping up cocktails deeply offends my sensibilities. And, mark you, I object less to her drinking the cocktails than I do to her presence in the bar. Cocktail drinking may be a harmless or a hazardous occupation depending upon the time, the place, and the company; but a bar room is always low, always common, never conducive to good manners and the young woman who enters one, lowers herself in her own estimation and in that of her escort, if he has any manly instincts. And so on *ad finitum*.

The causes of this decadence are several, if not many. First I would place the general effect of the great war which gave our social structure a severe wrenching. And second our colleges and universities are and have been for some time drawing students from social strata that heretofore have not been represented so largely upon the college campus. It is a natural manifestation of our attempt at universal education. Of course, there are still many students who can say with Marcus Aurelius "From my grandfather Verus I learned good morals and the government of my temper. From the reputation and remembrance of my father,

modesty and a manly character. From my mother, piety and beneficence, and abstinence not only from evil deeds but from evil thoughts." But I believe the proportion of such students is less than formerly though here again we should be careful not to confuse bad manners with bad morals. However, I am less concerned with the causes than I am with the remedies, if there be such, and I think myself that something constructive could be done.

First there must be a recognition on the part of trustees and faculties that the college graduate should be not only educated to the extent that is possible, but also that he should be moral *and* well mannered. This has already been recognized by some educational groups. The Newark College of Engineering for several years invited Mrs. Joseph Barker to deliver a series of talks to its students on this subject and her little booklet "The Technique of Good Manners" will repay reading. The new housing plans of Yale and Harvard are moves in this direction. One of the best attempts known to the writer is Balch Hall, a residential hall for women at Cornell. This building consists of four units each housing 75 girls and each with its own housemother, dining room, and social rooms. The student union building now becoming so popular can do much I think to set higher social standards, especially as concerns social functions such as dances. It is along these lines I believe that progress may be made and once the full significance of this need is appreciated it will greatly affect all of our ideas of housing for students, both men and women. The American dormitory for men is in general an "abomination before the Lord." There is usually not a single refining influence within its walls. The fraternities are generally not much better, although here are groups in which much could be accomplished.

I have in mind one such group, not exactly a fraternity, but similar in many ways. In the beginning for a number of years it was composed exclusively of engineering students and they were so fortunate as to be given a beautiful endowed house, the donor of which contributed considerable initial idealism to the organization. This group has succeeded in establishing a fraternity life that impresses itself upon the scholarship and manners of succeeding generations of students to a greater degree than any other of which I have knowledge. If a boy lives in the house a while, he cannot fail to feel its beneficent influences. And what this house has done, others can do if they are only so minded.

The question naturally arises as to whether the American male student can be regimented in his social surroundings, having enjoyed the widest liberty consistent with the accepted moral and legal code. Probably this cannot be done without considerable difficulty and the tendency at present is for men and women to

demand greater personal liberty upon the campus. Whatever is done must probably be done by precept and example and by surrounding the student with social influences and standards which he cannot escape. These must necessarily be closely connected with facilities for living at the university and may change somewhat the accepted and somewhat stereotyped conception of residential halls. It probably means a somewhat different conception of university life on the part of trustees and faculty or possibly it may mean a different type of trustee and faculty member. Possibly we should start by securing trustees and teachers who are learned, highly moral, and well mannered though I am not sure that some of us would enjoy such a highly rarified atmosphere. But it might produce the desired results for the old proverb truly says—"Good life and Manners maketh man."

Plato to whom we still must go for wisdom and advice makes Socrates define the problem thus, "Whom, then, do I call educated? First, those who manage well the circumstances which they encounter day by day and who possess a judgment which is accurate in meeting occasions as they arise and rarely misses the expedient course of action; next those who are decent and honorable in their intercourse with all men, bearing easily and good-naturedly what is unpleasant or offensive in others, and being themselves as agreeable and reasonable to their associates as is humanly possible to be; furthermore, those who hold their pleasures always under control and are not unduly overcome by their misfortunes, bearing up under them bravely and in a manner worthy of our common nature; finally, and most important of all, those who are not spoiled by their success and who do not desert their true selves, but hold their ground steadfastly as wise and sober-minded men, rejoicing no more in the good things which have come to them through chance than in those which through their own nature and intelligence are theirs since birth. Those who have a character which is in accord, not with one of these things, but with all of them—these I maintain are educated and whole men, possessed of all the virtues of man."

This classic definition stresses learning, manners and morals in that order and the criteria of the educated man laid down by Plato still holds for us and presents a challenge that we shall not long be able to ignore.

CHARACTER BUILDING

By R. L. SACKETT

Introduction

This Society chose to emphasize spiritual values in Education as its purpose for this Convention. Just what inferences are we to draw? Have home influences become less positive, or are environmental factors more destructive of spiritual poise? Certain evidences may make us more doubtful of the integrity and dependability of the coming generation. Are they superficial, or fundamental? There are cases of emotional instability, of moral vagaries, of the search for easy entertainment. At the same time there are those, as always, who are serious, stable, sane and who are seeking social usefulness and potential capacity for leadership. The older generation has always been alarmed lest the good cause be lost through the immaturity and apparent heedlessness of the coming age. That conditions may not be so bad as they appear is no reason for ignoring the fact that engineering education has been concerned more with technical aspects than with the spiritual ones which support all professional activities.

Engineering has unconsciously been offering the most insidious form of education in the intangibles of life. It is desirable that it should become conscious of its responsibility for training men who can and will discharge their obligations to society. The professional schools are open to criticism, if they graduate those of weak moral fibre who may fail under stress to do their duty.

Inheritance and Environment

Character is that compound of intangible influences called inheritance, environment and education, which develop moral excellence. The first includes racial, religious, family and personal strains of emotional and physical reaction.

Environment comprehends those subtle influences of the home, school, neighborhood, church and society. "A man is known by the company he keeps" is an old proverb and "company" includes the human influences on the job as well as during leisure. These powerful forces may lead to imitation of good patterns, or to revolt from constructive social purposes.

Education includes formal and informal schooling, the influence of teachers, the appeal of the studies and the vision of opportuni-

ties. Reading, conversation, clubs such as the Boy Scouts, Sunday School and many other agencies may contribute to the growth of character. Recreations may be positive or negative influences depending on physical, emotional and human factors.

History is full of the most astonishing figures which came with small endowment from early surroundings and grew into heroic characters. Others with fine family histories have ended in the penitentiary. It is often impossible to evaluate the influences which in the most devious ways have fashioned the great and the gross.

One conclusion seems inescapable, viz. that influences are constantly at work shaping our destinies. Plain information is a helpful factor by broadening our horizon and giving us the historical background and the biographies of those who have risen from adverse circumstances. We know that Lincoln read Weems' "Life of Washington." It may have had some, even powerful, influence on him.

Various Influences

A knowledge of ordinary literature should have more or less effect depending on the subject matter, the teacher and the response of the reader.

Increased leisure for the average worker has provided time for more entertainment, but the taste for good books has not increased. The current, popular forms of recreation are those calling for the least mental effort and productive of emotional rather than rational reaction.

The practices of adults are imitated by the youthful. The absence of sound literature in the home and being read, discussed and digested is a factor in any failure to promote good literary taste, if there is a failure. Good reading makes not only the full man but the finer man when measured by any enduring standard.

An understanding of science and its methods has its peculiar evidences for the susceptible. There is the exploration of the dreamer mixed with the restraints which the rigid laws of action and reaction impose.

Psychology makes its contribution by giving the student a clearer knowledge of how his mind works and how others respond to his personality.

All the usual forms of information including the newspapers and the movies weave their effect into the web of life. It is doubtful if they improve the pattern. Even government, by the nature of its laws and their enforcement, is a power in determining some of the most serious characteristics of a period. It may exert for-

midable forces on mass character as distinguished from individual variations from type.

There are periodic influences which stamp adults with certain elements of Christian character. There are other periods in which society slips its moral moorings and goes adrift. There are tides in human affairs which taken at the flood lead on to fortune; there are others which like the Lorelei beckon those who are susceptible on to the rocks.

The pioneer period helped to harden determination and independence; to induce charity and helpfulness.

The industrial period placed a premium on invention, investment, management and individualism. Integrity, energy, thrift and courage were required for success. The resulting wealth created social hazards that exalted ostentation, extravagance and unfair trade practices.

More recently we have seen the law flaunted, justice sometimes tainted with politics and morals a strange mixture of honest frankness and naive spiritual nudity. Such an agglomeration of the immature and the senile in moral issues has befogged social and political objectives and given birth to a strange confusion of social philosophies which point in all directions at once. The search of the modern Diogenes is not for honesty, but for expediency. The moral issue seems to have been taken out of social problems and placed in cold storage for a more convenient time.

Meanwhile youth is suffering from the jitters by which their elders are afflicted, and they look on with dissatisfaction at the slough of despond from which Christianity is slowly struggling. The flattery with which they are appealed to as the coming saviors of their country has in it a certain irony which they appreciate as no compliment to the character of those who would gladly transfer their self made yoke to the neck of another.

It is no surprise that students are charged with socialism, communism, extravagance, indolence and the supine indifference of their elders about the future corner stone of society, character.

What has technical education done to strengthen the moral purpose and social consciousness of its students? It has attempted by precept and example to emphasize the rigorous discipline of accuracy and of honesty. Day dreams and pretty speculation can have no place in the theory on which engineering principles are built. They should have no place in design or in the economics of engineering. Long experience leads me to believe that the discipline of engineering education has not relaxed during these forty years, but has strengthened. The realization of the increasing dependence of society for safety, health and life on the integrity of the engineer has led teachers to sense their responsibilities.

Registration laws, building codes and structural failures have enforced a clearer recognition of moral and legal liabilities.

Engineering education has certain virtues, and they have been traditions carried out in the classroom on the whole. The young engineer has rarely been guilty of criminal negligence—a tribute to his essential honesty and to his instruction.

The annals of professional engineering record few who were guilty of moral turpitude connected with their position. A small number are dropped from some of the engineering societies for unethical practices.

It should be noted that this is more severe than the action of the American Bar Association which disbars only for illegal practices and not always then. The American Medical Association *is less* severe in patroling its ethical or unethical practices.

In its moral and social obligations it seems safe to say that the engineering student respects natural law and the inevitable consequences of disobedience. The law of human relations, contracts, liability and the ethics of the engineering profession have some bearing on the support of or strengthening of character.

The most powerful influence is that of the teacher. Youth is sensitive to the fairness with which it is treated. He senses the conscientiousness, honesty and courage of the teacher, who is human and at the same time insistent on thoroughness, clarity and completeness. These are essentially moral qualities and are evidences of character.

If the engineering schools are to realize their social significance, it is necessary to heed two factors which have received less attention than their importance deserves. These are personal qualities and character.

We recognize the value of refined personal habits in our recommendations, but have not done all that we might to improve certain habits, crudeness or objectionable appearances. They may be termed the superficial evidences of character, but if they give a wrong impression, or interference with progress or appreciation they are subjects for consideration. It is certain that some fail to measure up to expectations because of neglect of or ignorance of the weight given appearances, language, habits and bearing.

Goethe said "Talents are nurtured best in solitude, but character, on life's tempestuous sea." The development of a rugged character during the formative period is the best insurance against failure when one is harassed by conflicting temptations and dangerous propaganda.

Emerson wrote in his "Journal," "The whole object of the universe to us is the formation of character." Those objectives which have endured through centuries had as their purpose the

building of more enduring mansions. The spirit has been more important than the word, and character has endured beyond works.

Long after the text has been forgotten there will remain in the minds of students those time worn grooves in which teachers impressed their spiritual makeup. And it was the reality that registered rather than the superficial. Alumni recall those subtle evidences of strength and weakness which are the teacher. These engraved monuments remain in the minds of young and old as the spiritual ego of those who have travelled on ahead.

Our lighter moments may be as fruitful in revelation of the real person as those of which we are more self-conscious.

It is our privilege to select young teachers who have an understanding of their liabilities. Their influence on the character of students may be more valuable than the letter of their lesson.

It is our responsibility to commend those who have knowledge and are well developing examples of what an engineer should be.

It is our business to select only those who are decent, inspiring, upright and promising leaders of youth. Better to know less and be more; to be deeply devout than superficially religious; esse quam videri, *i.e.*, to be rather than to seem.

After surveying all the mechanisms with which man has surrounded himself out of the abundance of his desires, Emerson said, in "Society and Solitude," "What have the arts done for the character, the worth of mankind? Are men better? 'Tis sometimes questioned whether morals have not declined as the arts have ascended." And after that pessimistic picture, he adds a more significant note, viz., "Every victory over matter ought to recommend to man the worth of his own nature." The victory of mind over matter has given man the time and the facilities for examining his ideals. His conquest of nature should make him a more significant self. The growing authority of man over men makes him a more dominant social force than he could be in a primitive organization. Here lies the field for which engineering is responsible. It has created the machine, has massed men and produced management. The latter calls for the finest mental and spiritual equipment, if the turgid social problems are to be solved and the muddied streams of politics are to be clarified.

Engineering education must assume its share of the burden which it has created. The call is for leaders who are mindful of all their obligations and who are masters of their own souls. Some leaders were born and not made. Better ones can be fashioned by devoted teachers with responsive students. The technique and talents for leaders are known. The touchstone is a brotherly love, a spiritual awareness, a devout, courageous generalship. Our social destiny lies more in the hands of technical men who are standard

bearers, faithful to the human trust imposed on them than ever before.

To this end there should be a greater consciousness of the forces constantly emanating from the teacher and impinging on minds still sensitive to high spiritual purpose. The cynicism of this generation is often but the shell within which the embryo yearns for light and air that shall give him nourishment toward the building of a sturdier character, greater social and economic worth.

The character of the engineer was never of greater import to social advancement than it is to-day, and engineering education may well be more conscious of its responsibility to help in the making of men of character who are to be our engineers and who may be social leaders with spiritual devotion to their responsibilities.

THE DRAWING DEPARTMENTS' OPPORTUNITIES IN SPIRITUAL ADJUSTMENT

By THOS. E. FRENCH

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The keynote of this meeting *"The Spiritual Adjustment of the Student"* was sounded yesterday by the President and has been carried on this morning. It will be my attempt very briefiy to indicate the preëminent position held by the Drawing Department in the opportunity to assist in this most important, intangible, part of the engineering student's education. The drawing department is a service department, and in the nature of its service develops unconsciously, at least to the student, the qualities included under this term "spiritual adjustment."

It has the opening advantage of involuntary interest. A boy enters college with a high emotional attitude. He has chosen his life's career, he is going to be an engineer, and to him drawing represents engineering. What pride he takes in his new drawing outfit! You remember yet your own first real set of drawing instruments and how proud you were of them. After twenty years you could still tell me the color of the velvet lining of the case. The first half-hour of the thrill of ownership of a slide rule in a new leather case is worth to the boy all he paid for it. And his sensation on finishing his first drawing! He may even strike the attitude of a conqueror in his satisfaction. It may not be a very good drawing but it must not be laughed at. That spirit is sensitive and easily killed. It must be fostered and encouraged so it will keep on coming. The civil engineer gets it the first time he looks through a transit. The thrill the boy gets in watching his first piece on a testing machine is shown by his tense pose till it breaks. It is upon that spirit of uplift, that enthusiasm, that the spiritual adjustment can be grafted, and if it can be held for four years, that boy will go out and rise to leadership.

The teachers of engineering subjects do not see the boy as he first comes to school with that emotional feeling. I wonder if it may sometimes happen that the lack of engineering interest in the teachers who meet him first may dull his enthusiasm by the time he reaches the degree-giving department. It must be remembered that the boy is in the sensitive period of professional adolescence and that he needs the same sympathetic help as is needed in physical adolescence. The other subjects in his freshman curriculum

are, in general, continuations of subjects he has already studied in High School, so he feels his drawing to be the only outlet for his engineering enthusiasm, which places the drawing teacher as largely responsible for the successful handling of the emotional situation. This in turn makes it highly essential that the organization of the drawing department be considered with a view to conserving all the experience and skill developed year by year in meeting these young enthusiasts.

Professional adolescence craves excitement and satisfaction for this excitement. The drawing room must provide an opportunity for a greater feeling of exaltation than is embodied in a technical specification, and must attempt to give it through the medium of things the boy has come to regard as symbols for engineering. The object, in general, of any lesson in drawing is to enable the expert teacher to adapt fundamentally important knowledge to the personal characteristics of the individual student, to develop the feeling of self-assurance, and with self-assurance comes mental strength, an attribute necessary to spiritual development. The drawing problem is the first unit in which self-judgment of a completed whole enters as a factor.

With the realization of the serious nature of the problem, the drawing department must consider each course and each exercise, analyzing it carefully to eliminate elements of irritation, futility and routine of tiresome repetition. In a positive way it should exert every effort to make the student feel that he is surely and rapidly progressing toward an ability to catch and express his visions in a clear and intelligible way.

The development of the sense of beauty, the appreciation of Louis Sullivan's famous alliteration "form follows function," makes for spiritual uplift, and can be taught, has been taught, in the drawing room.

Yesterday Dr. Mead in his address repeatedly used the word *Truth*. Without a definite and fundamental conception of truth there can be no spiritual advance. The engineering conception of truth must always lie in the development of its logic and a feeling of its rightness. No subject in the freshman's curriculum is so well adapted to cultivate these two things and to inculcate truth, the *whole truth*, as are the subjects of engineering drawing and descriptive geometry. It is half-truths that make most of the trouble in the world.

With truth as the basis there is the natural development of honesty, integrity and character, words we heard so often yesterday, all taught indirectly, without the student knowing it.

For intimate contact with the student only one other department gets closer to the skin, that is the Athletic department. From

my long contact with athletics I would not for a moment disparage the fine work done by this department in developing the higher instincts of the boys, even though many would say that the primary objective of most coaches was to win games. I recall a remark made once by Romeyn Berry, the inimitable graduate manager at Cornell, who said "In a losing season a coach has to build character like hell."

The boy we were talking about was justified in his feeling that his drawing was the outlet for his vision. For ages mankind has expressed its emotions in the form of drawing, and the type has been closely akin to his spiritual development. Through two dimensional drawings and three-dimensional carvings man has recorded his satisfactions, his vanities and his yearnings. As life became more complex, and demands more difficult of accomplishment he has met the situation by more scientific methods of graphic expression, until in the present highly technological age there is the fully developed engineering language taught to our technical students, the *one medium* in which the passion of the engineering mind to contribute to the material and spiritual welfare of the race can be expressed.

The engineer's drawing paper is in very fact the battle ground upon which the human intellect has conducted the long struggle for advancement from simple existence to a cultured outlook. All that the past has yielded is recorded there, all that the future holds of promise for better things must in large measure be written there. No dreams of future progress can be carried out without going through this stage. No searching science contributing to the welfare of the race can reasonably hope to come to reality without first developing line by line through the end of the engineer's pencil.

It has a great literature, this drawing, but the tragedy of it is that only the successes are recorded. Spiritually, man progresses more by virtue of his defeats than by continuous and uninterrupted success, but in drawing only the records of great achievements live. All the records of frustration, all the tragedy of great unmastered dreams are lost, where in other literature they live to become recognized in later years for the great values they have contributed as discipline. But "the engineers views hopefully the hitherto impossible."

In the not distant past there has been a distinct tendency to take away from the engineering student these opportunities for development by cutting the time devoted to drawing, sometimes almost to the extent of sending him out professionally illiterate in his own language. It came about through a lack of appreciation that teaching drawing was much more than teaching how to draw,

how to hold a T-square and sharpen a ruling pen. It is pleasant to record recent reaction to this tendency.

The drawing department *has* unusual opportunities for spiritual adjustment, as well as for orientation and guidance. But as President Anderson said "of most importance is the teacher himself." So, speaking to Deans and administrators: Encourage and use this department, and in your appointments, check the personality to be sure to have men in it of vision and character and consecration to the service of youth.

Discussion

Hale Sutherland (Lehigh University): The papers of the morning have placed before us with sanity and in very fine spirit certain considerations relative to student character and the influence thereon of our technical training. Dean Sackett has pointed to the grave social disorders which have come with technological advance and the responsibility of the engineering school to train men for social leadership who will discharge their responsibility to society. He has enumerated certain influences which affect character: inheritance, environment and education. Dean Kimball has listed learning, morals and manners as the three factors which greatly affect character and has urged that our colleges recognize a responsibility for its students in all three regards. Professor French has shown in a very persuasive way the possibilities before the drawing department for doing the thing which has been urged by both deans.

With the assent which I am sure we all extend to these three papers there arises in us a demand for definition. So far in our discussions in this convention we have taken "spiritual" adjustment to mean psychological and social adjustment, a perfectly proper and intentional limitation of the fundamental meaning. However it is usual to attach a more profound significance to the word "spiritual" as by William Kingsland who says: "It appears to be the best word at our command to express all those idealistic powers, our appreciation of truth, goodness and beauty, which are continually trying to find expression in our nature and are the very root and essence of everything which gives to life a fuller value and a deeper meaning than mere animal existence."

Everyone of us here today is aware of the presence within himself of these spiritual urges and aware of the resulting conflicts with other egotistical tendencies within and with the circumstances of social contacts of all varieties without, tendencies and circumstances which impede the expression of these idealistic powers. That is where adjustment comes in. And the universality of these

spiritual urges is the promise of success to the human adventure finally.

Kingsland's definition unifies the three papers under discussion. The appreciation of goodness is fundamentally a social urge: it leads to conduct characterized by that sense of responsibility to society desired by Dean Sackett. One who expresses his basic impulses in appreciation of truth, goodness and beauty inevitably expresses, or has, the learning, manners and morals set forth as desirable by Dean Kimball. In summarizing, Professor French spoke directly in terms of Kingsland's fundamentals.

I would agree with Dean Kimball in his assertion that the young people of today are characterized by higher moral sensibility than a generation ago. I do not share any pessimism he may have shown regarding their manners. The young men who come into my office these days exhibit far more of poise and good manners than was, I am sure, the case with myself and my classmates of thirty years and more ago.

Dean Kimball points out that modern learning is not commonly associated with wisdom. Perhaps the reason for this is the increase of materialism which marched along with the advance of modern science, a materialistic estimate of the world and life which has dominated—and still largely dominates—the thinking of our schools. The shallowness and lack of logic of this phase of opinion is being demonstrated today as science advances beyond the one-time ruling concept of indestructible matter. Rational thought and intuition alike lead us to an entirely different concept of things. "The Living Universe" is the pregnant title of one of L. P. Jack's books, a phrase which graphically suggests the new-old insight which states that fundamental reality is not matter and force but Consciousness, Life, Mind.

It makes a great deal of difference so far as concerns conscious effort to better character, manners and morals, what kind of a universe a man believes he lives in. Doubtless the picture of the struggle for existence in a mechanical universe has facilitated for many young men the adoption of jungle standards for personal and business life. He who believes that he lives in the presence of an all-pervading Life and Love in whose Being we have our roots, and who senses in life opportunity to advance from darkness to the light of some measure of conscious realization of his essential identity, has solved, or is far on the way to solving, the problems of character, manners and morals.

Evolution—the great explanatory contribution of science to our knowledge—must be a present as well as a past process. In a living universe evolution must be a continual advance to higher expressions of life and intelligence. We may conceive of our edu-

cational system as a factor in continuing human evolution, a view which explains why we are discussing spiritual adjustment. And how may our educational institutions fulfil this function?

It is a fundamental of our engineering teaching that confronted with a problem and supplied with the proper rational tools our students will work through to a solution. A practical first step in advancing our students toward individual excellence is to lead them to intellectual comprehension of the idealistic philosophy as a foil to the prevailing materialism. How many of our students in our crowded technical curricula have any notion at all that there is a serious intellectual judgment of the world which gives support to that which is the fundamental teaching of all great world religions, the insistence upon the spiritual nature of man, upon his essential unity with a reality which transcends the world of appearance and which is the inspiration and source of every excellence? Convinced of the rationality of their idealistic intuitions our students may be trusted to come through with idealistic solutions to the problems of life and society.

The necessary second step in the advancement of excellence in our student body has been asserted by all three speakers this morning: living examples in the flesh and in books must exert their silent contagion. Character is caught, not taught, says an old precept. General student opinion is not likely to accept any higher level of social or individual philosophy than the low one of the ordinary community unless there is perceived general acceptance of a creatively significant philosophy by the faculty.

Our consideration of student adjustment would not be complete without mention of the problem presented by the student who is seriously impressed by the widespread current criticism of the economic and international systems. If our organization is earnestly concerned with adjustment some day it will give rather lengthy consideration to this issue. At the moment there is time only to assert the responsibility laid upon faculties to exhibit sympathy and tolerance. Probably most of us have given only cursory attention to the critics of our social order and so we are not able to discuss these issues with young radicals in such fashion as to command their intellectual respect. However if we exhibit the tolerance which is incumbent upon us, patriotically, as descendants of the freedom announced in 1776, cosmically, in devotion to the search for truth, we shall command their respect as fellow humans.

Professor French has stated that this matter of adjustment should not be the concern of any one department. At Lehigh University I believe we realize that this is so, although we are giving to one department special responsibility in this field. A few

years ago President C. R. Richards became very much dissatisfied with the workings of compulsory chapel, an institution with us from the founding of the university. He became convinced that student opinion was correct in contemplation of compulsory chapel as something anomalous, that compulsion and the free spirit of religion have nothing in common. He found in the Reverend C. G. Beardslee a liberal minister who thoroughly agreed with this point of view. In 1931 Dr. Beardslee came to Lehigh and initiated a very significant program. Compulsory chapel was abolished. The faculty voted that all students be required to receive instruction in ethics and religion as philosophical matters, essential fundamentals for all educated men. This instruction may be received in chapel attendance through freshman and sophomore years or it may be taken by class attendance through a single year, a matter entirely within the choice of the student. The chapel services are conducted so that while they are exercises of instruction they may become services of worship for those attendants so wishing it. Dr. Beardslee's success has been marked. He has found it necessary to impose the utmost of rigor upon his class work in order to keep the size of his classes down to the limits he is able to manage working alone. Inevitably there has been criticism from those who object to liberal and impartial religious instruction with analysis and comparison of modern views of all varieties. There are many who do not trust young people to think for themselves. Dr. Beardslee has not attempted indoctrination of any sort: he has insisted simply that his students think through the bearings and implications of any creed to which they give adherence. It would seem that this phase of oversight, professional philosophical guidance of our young people in their religious questionings, is one which every educational institution owes its students.

Fred E. Ayer (University of Akron): I believe that it would be a lack in this program on the character development if some attention were not called to that phase of the work in coöperative engineering. I had expected that someone would call attention to the difference between character and reputation before now, reputation being what we think a man is and character being what he really is.

I should like to illustrate the effect of the coöperative training on character building by just one instance. There came to my office a boy whom I shall call Bill, accompanied by his mother. As soon as they came in I was treated to a veritable deluge of verbal Niagara. His mother told me Bill's history from the time that he showed his great intellectual capacity by lying in the cradle and breathing up to the time that he became cheer leader of the senior class in high school. Bill himself was garbed in the latest col-

legiate costume, with silk shirt, and socks, and so forth. I could readily picture Bill in that garb as the third assistant to a molder, cutting sand in a foundry. But he was taken in on trial, and, as was our custom at that time, he was started out on the job in the summer preceding his college work. He went out on two jobs and was uniformly successful in both of them: He got fired within three days. The coördinator asked me what we should do with him, because usually that ends the collegiate career of a coöperating student. I thought that Bill was worth while and ought to have another chance, so I had him in the office and talked with him. I said, "Bill, so far as I can see, there is only one thing wrong with you. You have a yellow streak right down your backbone about six inches wide." My intention was to make Bill mad, and if it had not been for my gray hair and the slippage of my chest I am afraid Bill would have taken at least one poke at me. I had succeeded a little better than I intended. I said, "I am going to send you out and I have instructed the coördinator to find the hardest job, the dirtiest job and the one with the lowest pay and send you out there. When you get through with the job go right on home because your academic career is finished."

I checked up with the coördinator a few days later and asked him where he had sent Bill. He told me that Bill now had a very important position as laundress in a garage. It was his job to take the parts and give them a bath in gasoline, and about the time he got immersed in the mixture up to the elbows somebody blew a horn and he had to go out and open the garage door. After two weeks, when we had heard nothing from either Bill or the employer, the coördinator went around to check up and he said, "How about Bill?" The garage foreman said, "If you've got any more men like Bill, send them down here. We'd like to have a shop full of them. He has been on the job regularly and he has done everything we told him to and we are perfectly satisfied with him."

So, whether it was the garage foreman, whether it was the college, or whether it was the insight of Bill himself, somewhere had been awakened a spark which had kindled and taken flame, and Bill had emerged from an irresponsible kid to a man and one who intended to make good.

And as we send these students out and they make these spiritual and practical adjustments in industry, we believe that we are contributing thereby very much to the development of their character.

C. J. Freund (University of Detroit): Professor Sutherland mentioned one or two serious obstacles which he thought stood in the way of the spiritual adjustment of the engineering student in our colleges. I believe there is one more obstacle or difficulty which

may well be added to his list, and that is this: The whole content of the engineering profession is, after all, primarily material. We deal in dimensions, in volumes and masses, and we have not yet taken very seriously those subjects and ideals which have to do with intangible, immaterial, spiritual values.

Regardless of what we may say here during this convention, the fact remains that all of us somewhat classify as belonging to an inferior class any subject such as economics or ethics, which is not in the purely professional range. That is, we cannot measure it. Therefore, it does not quite belong to the very first class of engineering subjects.

We talk a lot about economics and all that, but when we delve right down into our deepest viewpoints we do not accept those subjects as of the same consequence as those which have to do with purely material matters. I think that is probably the greatest obstacle which the engineering college has to overcome in the spiritual adjustment of the student.

Another thing. Yesterday morning President Frank suggested that we may be responsible, we engineers, for the mess we are in, or at least that we might well accept some of this responsibility. Very good. It seems to me that we have assumed so far that this mess we are in is the result exclusively of certain blunders or errors in the technical imposition of our engineering results upon the community or upon our civilization, and that the solution is technical. Suppose we look at it from another standpoint and tie it in with the viewpoint or the keynote of this convention? May I submit that these failures to adjust our engineering results to our civilization may be moral failures, not serious failures. I do not want to suggest that the engineers are grossly deficient morally, but by the accumulation of a lot of little moral deficiencies, any one of which standing alone does not amount to anything, we may have failed to adjust our engineering results to our civilization just as much as by any technical failure or any error in procedure.

If this is right (and it is just as likely to be right as the other answer), then a spiritual factor or element introduced into engineering education may eliminate that whole thing forever. I think it ought to.

I am sure that if the engineer keeps on working the way he is working today, and develops his engineering knowledge and content, and then obeys more strictly the moral laws and their application than he has even in the past, a lot of these maladjustments and difficulties involved in the relation of the engineering profession to civilization will disappear, will solve themselves. But of course before that is done we must first eliminate that viewpoint,

that the professional, scientific engineering subjects are the most important, and that the spiritual and intellectual subjects are of less consequence. We have got to get away from our mild contempt for the professor who teaches in a field which cannot be adequately measured.

Frank Cary Caldwell (Ohio State University): One thing that Dean Ayers said reminds me of an experience of some years ago when I was on the College Executive Committee. When a student would fail and come back for reinstatement, the committee as a rule would advise him to go and get at least a year's experience in some kind of practical work. Then, when he came back, if he had it in him he would generally make good. One of the committee, Professor Brown of our Civil Engineering Department, gave that procedure a name that seemed to represent the situation pretty well, "the red-headed boss prescription."

I have always been interested in the question of how education in character building should be combined with subjects of a mathematical nature. I could see that it came in naturally in sociological and economics courses, but it always seemed to me something of a problem to bring it into a course in electrical circuit theory. So I was quite surprised and pleased when one of my students remarked to me that he appreciated particularly the things along character building lines which I had said in class. I had not realized that I had been preaching, or doing anything very different from the usual class procedures. He did, however, seem to have received such an impression, so perhaps we shall venture to do a little more preaching in our technical courses.

I have always liked to think of engineers as present-day idealists. When you compare the engineer with the untrained man on the street, you notice certain differences which seem to me essential characteristics of his professional attitude. For instance, there is his dislike for waste. I think the average man on the street is not very much disturbed by waste. If he sees a lot of good equipment rusting beside the road, it does not usually cause him any personal distress unless it is something he is paying for out of his own pocket. But the engineer is troubled by such a situation. In that respect he has a certain moral point of view that has come from his engineering training.

Again, take the matter of honesty. Sometimes when I am talking to my classes with regard to how they should conduct themselves on examination, I contrast the situation of the engineer with that of other professions. We all know that it is a duty of the medical practitioner at times to deceive his patient. He must do it for the patient's good. Nobody questions the necessity for his doing so. Sometimes absolute honesty on the part of some mem-

bers of the legal profession is questioned. But when it comes to the engineer there is never any professional justification for dishonesty. You know it is an old saying that the doctor sees his failures buried but the engineer's failures are likely to bury him. So perhaps, after all, we have a good basis for the development of character in connection with our engineering teaching.

George H. Shepard (Purdue University): I picked up from the speech of the Governor of Indiana at our recent commencement a quotation from Aristotle. It is, "Virtue itself is merely intelligent behavior."

I jump from Aristotle to Henry Ford. A long interview with Henry Ford was recently published in the *Saturday Evening Post*. I went over it carefully afterward to see if I could boil it down to a very brief statement. I think this is it.

Henry Ford said that throughout his career he had made it a regular practice, as soon as he had succeeded in achieving an increase of efficiency in productive processes, to pass on a part of the resulting economy to the public in the form of reduced prices and a part of it to his workmen in the form of increased wages; and not only that, but he claimed that that is the panacea for our economic ills. Of course, that oversimplifies the matter, but there is not an opportunity here to go into any amplification, and realizing the oversimplification, I think we might accept that as as good a brief statement as could be made.

I began my career as an industrial engineer with Harrington Emerson, and I was very vividly impressed by the emphasis which he placed on his four ethical principles. As a matter of fact, if you take out of scientific management the ethical principles it may become a means of brutal exploitation and, if so used, justifies all the objections made to it. In order to overcome those objections and in order that the ethical principles may be applied, Henry Ford, in passing on to his consumers and to his employees their share of any saving effected in his plants, is practicing that intelligent behavior which Aristotle said is virtue; and in practicing the ethical principles which Harrington Emerson advocated, he is sacrificing his own immediate interest for his own long-time interest.

Harrington Emerson also used to say that the cent which a business man held close to his eye was to him bigger than a dollar that was held at arm's length. It is perfectly true that people tend to work for their own short-time interest instead of for their own long-time interest. There is a great tendency at present to try to correct that short-sightedness by coercion, social control and governmental compulsion. We recognize the danger and difficulties of such remedies. If they are to be avoided, it seems to me that a large factor in doing so, should be the work of the engineers in

showing people that what they need to work for is not their short-time interest, which is often anti-social, but their long-time interest, which is both in their own interest and also in the interest of society.

Leon H. Rittenhouse (Haverford College): We have heard a number of fundamentals brought to our attention again this morning. It is very, very proper and for one I appreciate the President's attempt in putting this on the program, as I am sure you all do. They have been brought very forcefully to our attention, and very eloquently.

Professor Sutherland, I think, has emphasized the issue, and that is: What to do about it? So far as I gather from the principal papers this morning, the precept and example, which are admirable, are something to do, and something that we all should do and are striving to do.

Not to take too much of your time, the points I had in mind are, first: This is a little different slant and I do not think it was mentioned, except in a negative way,—the problem being passed on to the schools. You may say, passing the buck. I am very serious about that, and I am not alone in that stand. I have known some individuals, one in particular who was in the public school system for 17 years. He felt so intensely on the important point of character training that he prepared a booklet at his own expense and sent it around. It was a little missionary work by a free lance. I think you will agree that that is the formative period, the important period, starting with the grade school and ending with the high school, of character training. I think this Society, while recognizing the problem, would do even better to emphasize the problem and put it up very strongly to the public school system, not only because of the future young men who are coming to be trained as engineers but for the future welfare of the country which we heard expressed so broadly and so many phases of only yesterday.

Just one more point: How are we going to handle it? I think if you will listen to the discussions and read some of their papers in the schools, in the Society, and elsewhere, you will find that they enunciate pretty much the same fundamental principles that we have listened to, both yesterday in President Anderson's keynote address and today. And, so far as I know (and I will admit that I do not know very much along this line, but I have followed it because of my interest in it), they have not done so very much else. There is a method that can be adopted, as has been adopted in one or two institutions, of the conduct record. That is a little different from precept and example. The conduct record is made by the individual and it is itemized on a piece of paper and I can see it and the world can see it. Most of you here have such things and I think you will get the point. It is a record kept of little delin-

quencies. As someone has said this morning, it is the repeated failures that count, and they are often passed over in the ordinary school system. If you keep that record you will see the reputation, and that is the important thing, one of the important things, to bring to the attention of the student and to that of his parents. Then, you may say, that is the question: What are you going to do with that? Well, a suggestion has been made. I will say, so far as I know, nothing has actually been done along this line in the public school system, but it is a suggestion. That brings out a point that was mentioned this morning by two or three of the speakers. They said and pointed out, and it was Dean Ayers, I think, who mentioned specifically that our future welfare depends upon character, that is the foundation. Certainly. All right. There has been a suggestion made for the public school system. This suggestion is the item I want to pass along to this group since you are interested in the problem. One of the men who discussed this a few minutes ago pointed out that we put some stress on the material things. There is an analogy there. What do they give the graduate in the high school? They give him a diploma for his scholarship. In place of that diploma for scholarship it has been suggested that they give a character diploma, and that character diploma to be earned by a good conduct record. It is maintained all through his years of training. That puts the emphasis where we all say it should be. When the pupils and their parents realize that, I think we will be taking a long stride toward the goal that we all hope to reach.

In conclusion, I would suggest as two things that this Society should emphasize is to do all they can to get the schools to take up this problem in the formative period of the lives of these young men and young women, and to give serious consideration to the efficacy of a conduct record. I hesitate almost in mentioning this in passing for fear of the wrong interpretation, but many of you know that conduct records are kept in the United States Naval Academy, and I presume, in the Military Academy, and with very satisfactory results. It is not that we would want to adopt that complete system or anything smacking of militarism. I know people somethime shut the door to it. But there is something in it and I want to pass along those two thoughts to you.

Harry Stanley Rogers (Polytechnic Institute of Brooklyn): We have been discussing this morning the spiritual and character development of the student. I want to take the temerity to discuss the influence of the faculty as manifested in their daily operations, upon that personal and professional nature of the student.

Professor Sutherland said, repeating that old axiom, that character is caught and not taught, and I want to take that for my

theme. It is the intangible subtle atmosphere that we have about an institution which, it seems to me, exercises more influence upon the boy's personality and character than any other one thing.

This year we buried one of our beloved emeritus professors, a thing which each school does sometime, a man who was characteristic of many men found in institutions throughout the country, a man who exercised a tremendous influence upon the student body. As a newcomer at Polytechnic it was my privilege to talk on many occasions with the alumni about him. At hardly any time did anyone mention the teaching of chemistry which he did in his class. The things which they remembered, the things which made the impression upon them, were the interjected remarks dealing with life, that he brought into his class. He left a very profound influence not only upon our student body but upon our faculty. Here is one opportunity to influence students.

It is quite the common thing, common in a gathering like this, to discuss the conditions in this, that and the other institution, that are unhealthy because of the obtruding or harsh personalities in various places, because of selfishness, because of conflicts in ideals and purposes in an institution. There, in the resolution of conflict, it seems to me, is another place where one of our great responsibilities lies. We have a great opportunity to show the young people what loyalty, what coöperation, what social responsibility and what unity in purpose and in outlook in an institution can mean. Now I do not mean to preach to the instructor in the classroom alone because I have a very firm conviction that loyalty begins at the top. If we are to exercise any influence upon the young men who come under us it must be an influence that is felt in the institution, that is apparent immediately in the atmosphere when one has contact with the institution. And therein it seems to me that we have another great opportunity to give vent and expression to higher spiritual forces and the aspirations that lie within us.

A GLANCE TOWARD CULTURE

By CLYDE W. PARK

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Recently, in a class of senior students, the perennial question of cultural studies came up for discussion. Having reached the end of their stay in college, these men were interested in looking back over the scholastic program which they had completed and in estimating its benefits. Their criticism, although frank and outspoken, was not narrow or unsympathetic. Mingled with some doubts and regrets concerning particular subjects was a sincere appreciation of the carefully planned training which they had received in certain fundamentals.

Of the omissions regretted, the two most often mentioned were public speaking and "cultural studies." Inasmuch as this was an oral discussion and several men did some rather effective speaking while stating their shortcomings, the first of these regrets may be set aside for the present. It is important, of course, and deserves consideration for its own sake, but it was not the point of major interest in this and subsequent meetings of the class. The students *used* oral English, but the main emphasis of their discussion was the bewildering question of "culture" and cultural subjects.

Obviously, a discussion cannot really begin until there is a definition of terms, as a basis for what lawyers call "a meeting of minds." It was here that a real difficulty arose. The word "culture," when used in a non-bacteriological sense, has acquired so many connotations that one hesitates to use the term for fear of being misunderstood. To some members of the class it suggested intellectual snobbery associated with the popular use of such expressions as "highbrow" or *intelligentsia.* It was thus attached to an exclusive group of people who freely admit their superiority and constantly voice their disdain for less favored mortals, especially for practical people. To others who took part in the discussion, the term had more of an art emphasis. They pictured a type of young man, perhaps not wholly imaginary, who dresses outlandishly, affects a mild bohemianism, talks with something of a lisp or drawl, delights in afternoon teas, and gushes effeminately over the latest æsthetic craze. He is the sort of art critic described

by Royal Cortissoz, in "Art and Common Sense," as one who raves about the "correggiosity of Correggio." According to one's point of view, he may be classified as belonging either to the *cognoscenti* or the *dilettanti*. Like a certain type of club woman pictured by Edith Wharton, he is one of those people who pursue culture in bands as though it were dangerous to meet it alone.

These two figures, representing a conscious intellectual or æsthetic superiority, were set up during the preliminary discussion, and it was necessary to knock them down before the discussion could proceed. This the class enjoyed doing. It became clear at this point, however, that we had been gathering, not so much ideas concerning culture as emotional reactions toward individuals and groups with whom the word had somehow become associated. It seemed unfair that these objectionable persons should be allowed to monopolize the term or to distort its real meaning.

As we considered the subject in a more calmly analytical frame of mind we still found a variety of interpretations, but this time they were more promising. To some, culture was primarily the possession of knowledge, although the precise fields of subject matter were much disputed. To others, it was a developed capacity to appreciate. Still others regarded it as a particularly rigorous form of mental discipline. From the standpoint of this last group the technical studies on which they had all been laboring were rated very high in cultural value.

These proposed explanations were next considered in the light of a definition of "culture" which was once given by former President Lowell of Harvard University. He said:

> Culture is enjoyment of the things that the world has agreed are beautiful; interest in the knowledge that mankind has found valuable; and comprehension of the principles which the race has accepted as true.

It was clear that this definition indicated a certain validity in each of the tentative interpretations that had been suggested, since it regarded culture as a combination of knowledge, attitude, and intellectual or æsthetic experience. In our discussion of the definition we noted particularly its recognition of several balanced elements in culture, its insistence upon a willingness to learn from tradition, and its suggestion of a branching out into diversified areas of subject matter.

The usefulness of the definition was further shown by the way in which it lent itself to expansion. Upon examining its implications we found clearly indicated a series of divisions which any interested person might supply for himself, and in terms of which he might check his neglected areas, or waiting opportunities. Af-

ter a good deal of deliberation over questions of omission, sequence, subordination, and phrasing, we arrived at a compromise outline. The following is a graphic picture of our tentative expansion of the definition.

Enjoyment of the things that the world has agreed are beautiful;

The Fine Arts
- Painting
- Sculpture
- Architecture
- Decoration
- Music

Literature
- Poetry
- Drama
- Fiction
- Essay
- Biography

History

Interest in the knowledge that mankind has found valuable;

Exact Science
- Mathematics
- Physics (Astronomy)
- Chemistry
- Biology (Botany, Zoölogy)
- Geology

Approximate Science
- Psychology
- Economics
- Political Science
- Social Science

Comprehension of the principles which the race has accepted as true.

Philosophy
- Logic
- Ethics
- Æsthetics

Religion

It was generally agreed that elements of cultural value might be found in all of the subjects included, and that a monopoly of cultural benefit could not fairly be claimed for any particular division of the field. For that matter, the divisions themselves were not always easy to separate and to keep apart, nor did a strict confinement in water-tight compartments seem desirable. In contrast with the assumed prevalence of specialization, we noted the recent growth of coöperative research, in which the efforts of several branches of science are joined in the solution of a single problem. As we considered the divisions which neighbored one another, evidence of the essential unity of knowledge was always cutting across the artificial barriers which had been erected between areas of subject matter.

History was given its central position and typographic emphasis because of its "common denominator" relationship to all the other subjects. On the side of form, or style or presentation, its affiliation with literature was evident, especially its nearness to essay and biography. Since history provides not only a record but also an interpretation of backgrounds and events, its relationship to art, literature, and philosophy seemed to us important as its identification with knowledge. The assumption was, of course, that history, by reason of its manifold contacts, would be taught and studied with a broadly cultural outlook and in a spirit of judicial impartiality.

The more we considered the question of subjects and values, the more we became convinced that it was the spirit, rather than the content, which gave study its cultural importance. It appeared to us that certain subjects were more likely of themselves to promise cultural development, especially subjects which emphasized standards and values and which stimulated the exercise of critical judgment. The humanities, including such subjects as Philosophy, Economics, English, German, Romance Languages and the Classics, seemed to have this emphasis to a marked degree. And yet, it was recognized that any of these potentially cultural subjects might be taught as something dry, exclusive and aloof, and in a spirit of narrowness and intellectual bigotry which would lead to the precise opposite of the liberal education with which they are traditionally associated. They need not and should not be popularized, pemmicanized, or otherwise devalued, but without sacrifice of scholarship they can be made interesting through recognition of their contacts with living subjects and issues. Only when they are presented in this way do they deserve to be called "The Humanities."

In our consideration of cultural subjects and their presentation, we finally placed the greatest emphasis upon the spirit and atti-

tude of the student himself. Cultural development may be encouraged, but it cannot be forced upon any one. In the strict sense, it cannot be taught, since it is a by-product of the individual's contact with a body of knowledge or an esthetic experience. This contact must evoke some sort of spontaneous reaction, or it is worthless. The student who spent several weeks reading an assigned novel because his roommate mischievously shifted the bookmark every now and then, was hardly in a position to benefit by a cultural course in literature. A selfstarting attitude and a genuine interest are necessary. Carelessness or indifference, to say nothing of hostility, can render ineffective the most elaborate program of cultural studies. But if appreciation and intellectual initiative cannot be directly transferred they can be awakened, and here the responsibility rests largely with the school. Notwithstanding a crowded curriculum, in which cultural elective courses are at an almost hopeless disadvantage in competition with essential technical studies, the idea of a well-rounded development can be kept constantly before the student. If the institution's policy is to make him see that without collateral interests to supplement his bread-and-butter training he is missing something that is important and even indispensable to him, he will be likely to find opportunities for himself. At any rate, he will make the most of the limited possibilities which are now available, and the period of his concentration upon specialized training will not interfere seriously with his normal cultural development.

Of course an academic situation which is described in such negative terms as "limited possibilities" and "non-interference" is far from satisfactory. The development of any one's cultural interests is a positive matter, and it is necessarily a continous process. For the college authorities to content themselves with a laissez-faire policy would be as unwise as for them to go to the opposite extreme and attempt the forcible feeding of culture. Freedom, but freedom under guidance, is generally recognized as a sound educational principle. Within the latitude implied by this principle the school can provide means for awakening the student's latent abilities, particularly those which are primarily critical or creative. Courses, not too causally elective, may be offered in at least some of the humanities and may be distributed strategically throughout the undergraduate period. In some cases they may be introduced by a general course in orientation. Collateral reading of carefully selected books, such as those recommended by Professor Atwood Townsend's committee, may be recognized as a basis for the granting of credit, preferably for qualitative, rather than quantitative, achievement. A further contribution, important though indirect, lies in the encouragement

of student participation in musical, dramatic, art, and literary organizations.

Since the acquisition of culture is continuous—and really lifelong, the ultimate question concerns what the graduate will do with the activities which have been started or accelerated during his college course. An ancient philosopher mentioned by Socrates criticized a contemporary for saying, "It is hard to be good" when he should have said, "It is hard to *become* good." Absolute culture, like absolute goodness, cannot be assumed to exist. The term is relative, and the individual's problem (and privilege) is that of a progressive approach toward an always unattainable ideal. The final test will come in that important phase of the educational process which a whimsical commentator has called "resuscitation after apparent graduation."

Discussion

Harold W. Bibber (Ohio State University): I thought, as I listened to what Professor Park said, of some of the students that I have seen imbued with the idea that the inclusion of what might be called cultural subjects in the formal curriculum had the rather grudging acceptance of the faculty of the engineering college or the engineering department in which they were registered. At Ohio State we try to get around that by having a survey course given in the electrical engineering department, and to the extent we are able to do so, to give an enthusiasm for the study of cultural subjects that are offered by other departments of the university. In this course there is also an inspirational urge, if we can hope to call it that, to individual activities of a cultural nature on the part of students. We encourage participation in musical groups, for example, and we try to stimulate the students to occupy their elective hours with courses that might be called cultural under Professor Park's definition. This survey course of which I speak is given by some of the members of the Department of Electrical Engineering who are at the same time dealing with these students on the technical subjects of volts, amperes, power factor, and so on. I think that the results of some years of trial show that there is definite effect on the students.

The second factor which I wish to mention is the attitude which the faculty take in their personal lives toward culture. It so happens that during the last year the fact that the head of our department occasionally attended art exhibits came to the knowledge of the student body. I think that it did no harm in furthering the end that Professor Park has mentioned. I think that the fact that other members of the department have interests outside of those of

a purely engineering character, a knowledge of which comes indirectly to the student, has an effective influence.

The value of having the student branches of the various professional societies include in their programs something of a cultural character is unquestionable. We have had several evidences of a rather successful stimulation of student interest in things cultural by an occasional program of such a character in the A. S. M. E. branch and in the A. I. E. E. branch.

W. F. Gerhardt (Wayne University): To add one more line of support to Professor Parks' very able argument, I should like to call attention to an article just off the press in *Collier's,* entitled "The Next War," by H. G. Wells. In describing two lines of theoretical advance toward the stable world, he points out the very grave necessity for the acquisition by every man and woman in the world of what he calls a synthesis of human knowledge. Most of you are more familiar than I am with Mr. Wells' writings, but I think this has a very great significance for the engineering profession, first because we are very largely the ones responsible for the advance in conditions that brought the critical period prior to the World War about, and because as a group of quantitative as well as qualitative thinkers we have a lot to contribute in connection with the thing that Mr. Wells has suggested.

I might just add one personal experience which may have no bearing at all, but to me it is suggestive. At Wayne this last semester among a small group of engineers we put on a small course in which we used as textbooks five of Mr. Wells' books, first, "The Outline of History," second, "The Science of Life," third, "The Work, Wealth and Happiness of Mankind," fourth, his "Autobiography," and fifth, "The Shape of Things to Come."

I mention this because the reaction was extremely interesting. I started out with some very meager knowledge of the subjects myself. I found I was far outstripped by the class, both in capacity to absorb details on a world scale and by the ability of these youngsters to bring the things into a combined whole.

I should like to add to Mr. Parks' very interesting presentation, this thought: that the acquisition of culture is not merely one of enjoyment, one of something added to what we already have, but perhaps it is something which faces us all as one of the world's great necessities.

SURVEY OF THE ENGINEERING PROFESSION *

By ISADOR LUBIN,

Commissioner, Bureau of Labor Statistics

Foreword

Prior to 1929 the professional groups as a whole were not acutely concerned with such things as unemployment, employment, or reductions in earnings. This was not so for the period 1929–1934. Unemployment became acute as the depression lengthened in time and increased in intensity. The possibilities in the nonengineering fields grew fewer and fewer, first because the experienced engineers found themselves competing with new graduates, and second, these two together were in turn competing for work with the unemployed in other professional and non-professional groups. As the engineering profession became more and more aware of the acuteness of the situation, committees were formed throughout the country in an endeavor to cope with these unusual conditions; but they were immediately confronted with the lack of reliable data, which, if available, could have been used as a basis on which to formulate plans to ameliorate the conditions. Toward the end of 1934, at the request of American Engineering Council, the Bureau of Labor Statistics undertook a survey of the engineering profession in cooperation with a committee representative of its activities.

The purpose of the survey was to determine the extent of unemployment, what kind of employment was available to engineers, and at what compensation. To provide a comprehensive background for these data, the survey included the salient features of education and experience subsequent to graduation.

The data were obtained through the medium of a mail questionnaire, requesting information for the three periods ending December 31, 1929, 1932, and 1934. They covered present residence; marital status and number of dependents; type of education; employment; unemployment; earnings; membership in engineering societies; method of obtaining employment together with information on contract, patent, pension, and civil service privileges; field of activity and type of employment within that activity; and professional class. A copy of this questionnaire was sent to 173,151

* Delivered before the 44th Annual Meeting, S. P. E. E., University of Wisconsin, June 23–26, 1936.

engineers. The mailing list was compiled for the Bureau through the coöperation of various national, state and local engineering societies, while additional names were obtained from 32 State Boards of Engineering Examiners and the deans of 156 engineering schools. At the time the request for names was issued, there were known to be in existence 80 national, 42 state, and 197 local engineering societies, and of these respectively 73, 39, and 121 submitted names from their past and present rosters. Obviously, since the coöperating bodies embrace every phase of engineering activity, the original mailing list, from which duplications were eliminated, can be accepted as being representative.

Of the 173,151 questionnaires sent out 58,388, or 33.7 per cent, were returned with information; 5,883, or 3.4 per cent, were returned as "not found"; and no replies were received from 108,880, or 62.9 per cent. The net number of usable returns was 52,589, or 30.4 per cent of the number of persons on the original mailing list, a most gratifying response, especially in view of the fact that no follow-up method was used. The returns covered every state in the Union and the District of Columbia, and ranged in number from 101 in Nevada, to 7,659 in New York. In view of the small number of returns from individual states—in only thirteen cases were more than 1,000 reports received from a single state, while in twenty-four states less than 500 were received—the states were grouped according to the census geographical divisions, with the single exception that the District of Columbia was segregated from the South Atlantic Region and presented separately. This segregation was deemed advisable owing to the fact that the majority of engineers reporting from the District of Columbia were in the employ of the Federal Government. On a regional basis, the returns from all professional classes ranged from 948 in the District of Columbia to 14,977 in the Middle Atlantic Region.

The number of returns makes this survey unique in two respects, (1) size, and (2) comprehensiveness. With regard to size, three previous major studies can be cited; first, the one made in 1924 by the Society for the Promotion of Engineering Education of engineering graduates and non-graduating former students, which dealt with data collected from 7,000 individuals; second, the American Society of Mechanical Engineers' study of 1930, which was based on returns from approximately 8,000 engineers; and third, the American Society of Civil Engineers' study of 1934, which included 16,000 engineers. It is no exaggeration to say that this is the first time that data have been collected sufficiently elaborate to compare the status of engineers in the several branches of professional activity under approximately the same conditions on a nation wide basis.

TABLE 1

DISTRIBUTION OF PROFESSIONAL ENGINEERS REPORTING, BY GEOGRAPHICAL DIVISION AND STATE

Geographical Division and State	Number Reporting	Geographical Division and State	Number Reporting
United States	52,589	New England	4,674
		Connecticut	934
District of Columbia	948	Maine	322
East South Central	1,544	Massachusetts	2,717
Alabama	343	New Hampshire	227
Kentucky	402	Rhode Island	313
Mississippi	268	Vermont	161
Tennessee	531	West North Central	4,978
Mountain	2,434	Iowa	902
Arizona	369	Kansas	740
Colorado	908	Minnesota	1,265
Idaho	197	Missouri	1,224
Montana	291	Nebraska	398
Nevada	101	North Dakota	172
New Mexico	156	South Dakota	277
Utah	254	Pacific	5,651
Wyoming	158	California	4,389
West South Central	2,486	Oregon	427
Arkansas	171	Washington	835
Louisiana	481	East North Central	10,977
Oklahoma	509	Illinois	3,689
Texas	1,325	Indiana	1,316
South Atlantic	3,920	Michigan	1,951
Delaware	195	Ohio	2,999
Florida	626	Wisconsin	1,022
Georgia	592	Middle Atlantic	14,977
Maryland	628	New Jersey	3,323
North Carolina	421	New York	7,659
South Carolina	295	Pennsylvania	3,995
Virginia	678		
West Virginia	485		

DISTRIBUTION OF THE DATA BY PROFESSIONAL CLASS

With the data compiled on a national basis, consideration was next given to the distribution of the number reporting in each of the professional classes. From the Office of Education returns, it was found that, while the number of professional classes was large, mainly due to specialization, in the main between 80 and 90 per cent of the total engineering graduates in any one year were confined to the nine major professional classes of agricultural, architectural, ceramic, chemical, civil, electrical, industrial, mechanical, and mining and metallurgical engineers. For the purposes of this survey, the data were broken down into these nine categories.

Those engineers reporting a minor professional class were combined with the major professional class to which they were most closely allied, and as a result the range for the nine professional classes is from 388 for ceramic engineers to 19,891 for civil engineers.

In checking the sample, it was necessary to take cognizance of the fact that the survey included both recent graduates and older engineers. To check the former, the data of the Office of Education for the years 1930 to 1934 were used, while to check the latter, the 1930 Census figures on professional engineers were utilized.

In the case of the recent graduates, the chemical, civil, mechanical, and electrical engineers, when combined, constituted 91 per cent of the sample as compared with 73 per cent shown by the Office of Education returns for annual graduates. The remaining five professional classes amounted to 9 per cent of the sample as compared with approximately 27 per cent of the annual graduates as shown by the Office of Education.

In order to check the returns from the older engineers in the sample, it was necessary to arrange the data on the basis shown in the 1930 Census. The number of older engineers in our sample in 1935 constituted 15 per cent of the total reported in the 1930 Census. The total of recent and older engineers in our sample comprises 20.2 per cent of the total 1930 Census figures.

While the questionnaire contains thirty-five distinct items, among which it will be possible to derive numerous correlations, I shall deal only with the following salient features: education, employment, unemployment, income, zone of interest or field of activity, and type of employment within that activity.

Educational Qualifications

Data were obtained to determine the trends in professional engineering education, particularly, (1) the prevalence of first degrees in engineering, (2) the extent of postgraduate work, (3) the tendency of engineers to transfer from the course of specialization to other fields, and (4) the extent to which graduation from engineering colleges is necessary to obtain professional engineering status.

The importance of first degrees in engineering is borne out by the fact that in no case is the percentage less than 69.9 of the total in any one of the nine professional classes. The range runs from 69.9 per cent for architectural to 79.7 per cent in the case of ceramic engineers. As to the extent of postgraduate work in engineering, it is very small indeed, ranging from 3.5 per cent for industrial to 14.3 per cent in the case of agricultural engineers, although it

TABLE 2

DISTRIBUTION OF THE 9 PROFESSIONAL CLASSES OF ENGINEERS IN THE UNITED STATES, 1934, BY TYPE OF EDUCATION

Type of Education	Agricultural		Architectural		Ceramic		Chemical		Civil		Electrical		Industrial		Mechanical		Mining and Metallurgical		Total	
	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Prof. Class	Net Number	Per Cent of Total
Postgraduate Engineers	57	14.3	22	4.1	37	9.5	486	13.8	787	4.0	791	6.9	35	3.5	610	4.6	206	9.3	3,031	5.8
First Degree Engineering Graduates	299	75.4	376	69.9	309	79.7	2,632	75.1	14,023	70.4	8,912	77.9	769	76.3	9,920	75.0	1,609	73.6	38,849	73.8
Non-Engineering Graduates	13	3.2	36	6.7	16	4.1	212	6.0	457	2.3	206	1.8	33	3.3	240	1.8	91	4.2	1,304	2.5
College Engineering Course, Unfinished	17	4.3	67	12.5	16	4.1	154	4.3	2,950	14.8	862	7.6	97	9.6	1,299	9.9	189	8.7	5,651	10.8
Noncollegiate Technical School	5	1.3	26	4.8	5	1.3	20	.6	1,124	5.7	517	4.5	52	5.2	879	6.7	55	2.5	2,683	5.1
Secondary School	6	1.5	6	1.1	5	1.3	3	.1	511	2.6	140	1.2	18	1.8	245	1.8	33	1.5	967	1.8
Total Not Reporting	—	—	5	.9	—	—	5	.1	39	.2	15	.1	3	.3	33	.2	4	.2	104	.2
Grand Total	397	100.0	538	100.0	388	100.0	3,512	100.0	19,891	100.0	11,443	100.0	1,007	100.0	13,226	100.0	2,187	100.0	52,589	100.0

appears to be important in agricultural, chemical, ceramic, and mining and metallurgical engineering, where the percentages are respectively 14.3, 13.8, 9.5, and 9.3.

In regard to the extent to which engineers transfer from the course of specialization to other professional fields, it is sufficient to point out that the proportion of all engineering graduates whose professional work differs from the field in which they specialized at school ranges from 3.2 per cent among electrical to 35.8 per cent among industrial engineers. Of the 52,589 engineers reporting, only 4,413, or 8.4 per cent, were graduates who were practicing in another branch of the profession than the one for which they had qualified in college. Hence, considering the fact that some transfers in professional work are inevitable and that these are largely concentrated in but a few professional classes, it can only be concluded that this tendency is an insignificant factor. The importance of this fact, in terms of the efficacy of the respective curricula to meet the needs of the profession, is something that you who are specialists in this field must determine for yourselves.

Before discussing the extent to which graduation from engineering colleges is necessary to obtain professional engineering status, it should be remarked that nonengineering graduates (for purposes of classification I shall call them "other engineers") also include engineering graduates with degrees in nonengineering fields. The nonengineering graduates are those who had only a degree in liberal arts, and they comprise 1,304, or 2.5 per cent of the 52,589 engineers reporting. The engineering graduates with degrees in nonengineering fields number 498 (or 0.9 per cent of the grand total). These persons had originally graduated in engineering, but later they went into other fields of study, such as economics, business administration, law, etc. The small number found in this class is a substantiation of the fact that there is not only little transfer of occupation within the profession but also little transfer to preparation for professional work in fields other than engineering.

Engineering educators have for many years been aware that the "mortality" among engineering students is very high. The number covered by the present survey who reported that they did not finish the engineering course in college was 5,651, or 10.8 per cent of the total. By individual professional classes, the largest percentage who continued as engineers but without graduation was found among civil engineers, 14.8. The smallest percentage was 4.1 per cent, among the ceramic engineers.

Noncollegiate technical-school engineers numbered 2,683, or 5.1 per cent of the grand total reporting. With reference to the indi-

vidual professional classes, the largest percentages in this group are found in mechanical, civil, industrial, architectural and electrical engineering, being respectively 6.7, 5.7, 5.2, 4.8, and 4.5, while the range for the four remaining classes is from 2.5 per cent for mining and metallurgical to 0.6 for chemical engineers.

Nine hundred and sixty-seven engineers, or 1.8 per cent of the total, reported that they had had only a secondary-school education. The largest number in this group were civil and mechanical engineers, the total of these being 756, or 78.2 per cent of the 967 reporting.

Among the 33,852 "older" engineers, 24,837, or 73.4 per cent, reported graduation up to and including 1929. This compares with 9,015 "other engineers" (26.6 per cent) who did not report graduation but were born within the period ending with 1909. Of the engineers classified as "recent," that is, those entering the profession after 1930, 18,451, or 98.48 per cent, reported that they graduated between 1930 and 1934. In contrast, there were only 286, or 1.52 per cent, "other engineers," *i.e.*, those who did not report graduation, but were born within the period of 1910–1914. The enormous decrease in the ratio of "other engineers" to graduates as between the older and recent engineers is the best evidence that graduation in engineering is almost a necessity for entry into the profession.

That the demand for graduation as a qualification for professional status in engineering is not a recent development is clearly brought out by the fact that the percentage of engineers who did not complete their college course in each age classification rises gradually from 6.3 for those born in 1874 to 16.2 for those born in 1900–1904, after which it declines to 3.9 for the persons born during 1910–1914. The decline in the percentage is even more marked in the case of engineers from noncollegiate technical and secondary schools. Among engineers from noncollegiate technical schools, the peak was reached with a percentage of 17.8 for those born in 1890–1894, dropping to only 1.9 per cent for those born between 1910 and 1914. Likewise, for engineers with only a secondary-school education, the highest proportion, namely 17.1 per cent, was found in the group born between 1885 and 1889. In the group born between 1910 and 1914, the percentage was 1.7. The small percentage of recent engineers, compared to the large percentage of older engineers, in each of these three groups of nongraduates again emphasizes the fact that the chances of attaining professional status without a college degree have markedly decreased.

Trend of Employment, 1929–1934

Information was secured for twelve types of employment, as well as for unemployment and direct relief for three distinct periods, namely, December 31, 1929, 1932, and 1934. For the purposes of this discussion, only the data concerning civil, electrical and mechanical engineers for four categories will be presented. These are (1) private firms or organizations, including any other employment, (2) Federal Government, (3) nonengineering work, and (4) wholly unemployed and direct relief.

These four categories are typical for the types of engineers covered, in that more than 50 per cent of all graduate civil and 78 per cent of the electrical and mechanical engineers fall within them. As for the "other engineers," the percentage covered by these four categories is approximately the same as for graduates.

For each of the professional classes, the data have been broken down for all graduates grouped by the following classes: (1) 1933–34, (2) 1930–32, (3) 1925–29, and (4) all graduates up to and including 1924. The data for "other engineers" will be presented by year of birth in five-year class intervals: (1) 1905 to 1909, (2) 1900 to 1904, and (3) up to and including 1899.

TABLE 3

Trends of Employment for all Civil, Electrical, and Mechanical Engineers for the Years 1929, 1932 and 1934

Kind of Employment	1929 Employment				1932 Employment				1934 Employment			
	All Graduate Engineers	Per Cent of Total	All "Other" Engineers	Per Cent of Total	All Graduate Engineers	Per Cent of Total	All "Other" Engineers	Per Cent of Total	All Graduate Engineers	Per Cent of Total	All "Other" Engineers	Per Cent of Total
Total Reporting.....	14,374	100.0	5,102	100.0	19,886	100.0	5,024	100.0	24,416	100.0	4,897	100.0
Private Firm or Organization.....	11,777	81.9	4,320	84.7	11,311	56.9	3,298	65.6	13,194	54.0	3,224	65.8
Federal Government	1,182	8.3	328	6.4	1,937	9.7	445	8.9	3,527	14.5	742	15.2
Nonengineering Work.....	1,294	9.0	388	7.6	4,089	20.5	582	11.6	6,062	24.8	611	12.5
Unemployed plus Direct Relief.....	121	0.8	66	1.3	2,559	12.9	699	13.9	1,633	6.7	320	6.5

When all graduates reporting for 1929 are combined, the percentage distribution among the four categories was 81.9 for private firms, 8.3 for Federal Government, 9.0 for nonengineering work and 0.8 for wholly unemployed. By 1932 the corresponding distribution was 56.9, 9.7, 20.5, and 12.9; and by 1934, 54.0, 14.5, 24.8, and 6.7. With reference to the "other engineers," with the data combined for the unfinished college, noncollegiate technical-school, and secondary-school groups, the distribution by the four

kinds of employment were as follows: in 1929, 84.7 for private firms, 6.4 for Federal Government, 7.6 for nonengineering work, and 1.3 for wholly unemployed; in 1932, 65.6, 8.9, 11.6, and 13.9; and in 1934 they were 65.8, 15.2, 12.5, and 6.5 per cent. That is to say, for all engineers in the country, employment with private firms or organizations had decreased markedly as between 1929 and 1934, from 83 to 56 per cent.

There was a large increase in the number employed by the Federal Government, from 7 to 15 per cent. The increase in the number in nonengineering work was more pronounced among the graduates than among "other engineers." The increase in unemployment as between 1929 and 1932 and the decrease as between 1932 and 1934 were similar for both graduates and "other engineers."

The Distribution of Civil, Electrical and Mechanical Engineers According to Kind of Employment

Considering first the 1933–1934 graduates, the percentages reporting as being wholly unemployed as of December 31, 1934, were 8.8, 11.4, and 7.7 respectively for civil, electrical, and mechanical engineers. In nonengineering work 20.6 per cent of the civil engineers were employed. Forty-four per cent of the electrical and 31.9 per cent of the mechanical engineers were on nonengineering work. It is significant to note that 18.1 per cent of the civil engineers were employees of the Federal Government, while only 2.6 per cent of the electrical and 2.0 per cent of the mechanical engineers reported were in the Federal service. Only 19.8 per cent of the civil engineers graduating in 1933 and 1934 reported as being in the employ of private firms, whereas 34.5 per cent of the electrical and 50.7 per cent of the mechanical were so employed.

For the 1930–1932 graduates it is possible to get a better picture of the trend of employment, since the data are available for two periods, that ending December 31, 1932, and that ending December 31, 1934. For each of the professional classes the year 1934 showed a distinct improvement in employment conditions. In the case of the civil engineers, the percentage of unemployed dropped from 14.2 in 1932 to 2.9 in 1934; for electrical engineers, from 20.1 to 4.4; and for mechanical engineers from 14.8 to 3.9. It should be noted, however, that an appreciable number were still employed on nonengineering work. The percentage of civil engineers on nonengineering work dropped from 19.8 in 1932 to 17.0 in 1934—the percentage of mechanical engineers declined from 29.7 to 27.5 But electrical engineers so employed increased from 36.4 per cent in 1932 to 43.7 per cent in 1934. For all three professional classes,

there was an increase in the number employed by the Federal Government, the increase being from 13.1 to 24.7 per cent for civil engineers, 1.5 to 3.3 per cent for electrical engineers, and 2.6 to 4.6 per cent for mechanical engineers. As for those engineers reporting employment with a private firm or organization, civil engineers decreased from 18.7 to 16.5 per cent in 1934, but electrical and mechanical engineers respectively increased from 33.9 to 39.1 per cent and 44.6 to 56.3 per cent in 1934.

Referring now to the 1925–1929 graduates, there have to be considered here the changes over the three periods 1929, 1932 and 1934. There was a marked decrease in unemployment among all three professional classes from 1932 to 1934. For civil engineers the percentages for the three periods 1929, 1932 and 1934 were respectively 0.3, 9.1, 2.3; for electrical engineers, 0.5, 9.7, 3.7; and for mechanical engineers, 0.6, 10.1, and 3.7. In the case of nonengineering work, the distributions were as follows: for civil engineers, 2.3 per cent in 1929, 8.5 per cent in 1932, and 8.0 per cent in 1934. The corresponding distributions for electrical engineers were 6.9, 14.3, and 19.3 per cent; and for mechanical engineers, 5.7, 12.4, and 13.5 per cent. The importance of Federal employment for civil engineers is borne out by the comparison between this group and the electrical and mechanical engineering groups. In 1929, 13.8 per cent of the civil engineers were in the employ of the Federal Government. By 1934 the percentage had increased to 26. Electrical engineers, on the other hand, increased only from 2.1 per cent in 1929 to 4.3 per cent in 1934 and mechanical engineers from 3.9 to 6.8 per cent.

By contrast, the distributions for employment with private firms or organizations were very striking indeed. In 1929, 44.8 per cent of the civil engineers were so employed, but by 1934, the percentage had decreased to 20.9. For the other two professional classes the decreases were as follows: for electrical engineers, from 82 per cent in 1929 to 60.3 per cent in 1934 and for mechanical engineers from 79.9 per cent to 63.4 per cent in 1934. The mechanical engineers were the only group that showed an increase for this kind of employment as between 1932 and 1934.

For the graduating classes up to and including 1924, there was again a marked improvement in the employment situation. In the case of the civil engineers, the distributions on unemployment were 0.7 in 1929, 8.3 in 1932, and 4.2 per cent in 1934; for electrical engineers, 0.4 per cent in 1929, 6.0 per cent in 1932, dropping to 4.5 per cent in 1934; for mechanical engineers, 0.8 per cent in 1929, 8.7 per cent in 1932, dropping to 5.2 per cent in 1934.

Those mechanical, civil, and electrical engineers reporting non-

engineering work showed marked increases in the number so employed through the three-year periods, ranging for electrical engineers from 8.6 per cent in 1929 to 12.8 per cent in 1934; and for mechanical engineers from 7.2 to 10.8 per cent. In the case of civil engineers, the range was from 6.2 per cent in 1929 to 8.6 per cent in 1934.

The importance of the Federal Government as an employer of civil engineers is again recorded by the fact that the percentage of all graduates up to and including 1924 in Federal employment increased from 8.3 in 1929 to 16.2 in 1934. For electrical engineers the increase over the same period was from 1.8 to 3.3 per cent and for mechanical engineers from 3.2 to 4.9 per cent.

As in the case of the previous graduating classes, the civil engineers reporting employment with a private firm or organization also showed a marked decrease from 40.4 per cent in 1929 to 24.8 per cent in 1934. For the same kind of employment, electrical engineers showed a decrease from 72.6 per cent in 1929 to 60.5 per cent in 1934. Mechanical engineers showed approximately the same percentage of decrease, namely, from 68.4 per cent in 1929 to 57.5 per cent in 1934.

In comparing nongraduate "other engineers" with graduates of engineering colleges, it was found that the trends of employment for the three periods 1929, 1932, and 1934 were similar to those for the graduate civil, electrical, and mechanical engineers. Unemployment among nongraduates in 1932 was more acute than among graduates. The improvement between 1932 and 1934 was, on the average, not so marked. However, as in the case of graduates, employment with the Federal Government showed a distinct rise, although here again there was a marked difference between the percentage of civil engineers and the mechanical and electrical engineers who were so employed.

Employment with private firms showed marked decreases for civil engineers from 1929 to 1932, and further decreases in 1934. On the other hand, the mechanical-electrical engineers group, while decreasing markedly from 1929 to 1932, showed slight increases for all year-of-birth groups as between the periods 1932 and 1934.

The second group of the "other engineers" to be considered was that embracing noncollegiate technical-school engineers. Here unemployment in 1932 was very acute indeed, but by 1934 the percentage unemployed had dropped, on the average, from 12.0 per cent to 4.0 per cent. The percentage of those reporting non-engineering work as their employment over the three periods remained fairly stable. As for Federal Government, each of the groups showed a steady increase from 1929 through to 1934; while for private firms or organizations a marked decrease was noted for

all year-of-birth groups from 1929 to 1932 with little or no improvement as of December 31, 1934.

TABLE 4

AVERAGE PERIOD OF UNEMPLOYMENT IN MONTHS FOR ALL CIVIL, ELECTRICAL, AND MECHANICAL ENGINEERS FOR THE PERIOD 1929–34

Type of Education	Civil Engineers	Electrical Engineers	Mechanical Engineers
Graduate Engineers—All U. S. A.	←	13.7	→
"Other" Engineers—All U. S. A.	←	17.7	→
Graduate Years:			
Classes 1933–34	8.5	9.3	8.5
Classes 1930–32	12.8	15.6	13.2
Classes 1925–29	10.6	13.5	13.5
Classes Prior to 1925	16.9	18.1	18.4
College, Incomplete, Engineers	16.1	←18.6	→
Noncollegiate Technical-School Engineers	←	18.9	→
Secondary-School Engineers	←	16.3	→

TREND OF UNEMPLOYMENT, WORK RELIEF, AND DIRECT RELIEF

One of the most significant questions answered by our survey was: What was the average period during which engineers were wholly unemployed? on C.W.A. or work relief? or on direct relief? Considering, first, all graduates, information was furnished by 5,862, or 42 per cent, of the civil engineers, by 3,501, or 33 per cent, of the electrical engineers and by 3,606, or 33 per cent, of the mechanical engineers.

For the graduating classes of 1933–34, the average period of unemployment for those furnishing information on the extent of unemployment in the three professional classes was 8.5 months. The next most recent group, namely the 1930–1932 graduates, showed distinct increases, being 12.8, 15.6, and 13.2 months respectively for civil, electrical, and mechanical engineers. The average period of unemployment for the 1925–1929 graduates was 10.6 months, which contrasts somewhat favorably with 13.5 months for the corresponding graduating classes of electrical and mechanical engineers. The data for all graduates up to 1924 were combined and from these there was obtained an average period of unemployment of 16.9 months for civil engineers, but for electrical and mechanical engineers the periods of unemployment were respectively 18.1 and 18.4 months. This very definitely shows that no one of these three professional classes escaped the effects of the

depression, although the older groups of civil engineers fared slightly better than the corresponding groups of electrical and mechanical engineers.

The graduates reporting employment on C.W.A. or work relief showed an average period of 6 months for all three classes of engineers. As for direct relief, failure of a sufficient number to specify whether or not they had been on relief made it impossible to tabulate any information on this subject.

Considering now the unemployment among nongraduate engineers, it is interesting to note that when the civil, agricultural and architectural engineers were combined, the average period of unemployment was found to be 16.1 months in contrast to the average period of 18.6 months for mechanical and electrical engineers combined. In other words, even among nongraduate engineers there was a tendency for the unemployment to be less severe among the civil engineers. For all noncollegiate technical-school engineers, the average period of unemployment was 18.9 months and for all secondary-school engineers, 16.3 months.

These summary data appear to indicate that even in a time of depression, there is some advantage in having graduated from college, in that, the average period of unemployment for all graduates reporting in the country as a whole was 13.7, whereas for all nongraduates, for the country as a whole, the period was 17.1 months.

Distribution of Civil, Electrical, and Mechanical Engineers According to Their Zone of Interest and Functional Classification

A further significant item of information sought by our survey was: Where and how do engineers earn their living?

The analysis of our data serves a two-fold purpose, (1) to determine more exactly, than has hitherto been known, the fields of activity of each professional class, and (2) to obtain a more precise measure of unemployment as of December 31, 1934. For the purposes of this discussion, the combined data covering graduates and "other engineers" are presented for each professional class.

Considering first the degree of unemployment, the percentage range for the nine professional classes was from 22.6 for agricultural to 57 for architectural engineers. That is to say, as of December 31, 1934, unemployment was still very acute in the engineering profession in that the average for all engineers was 33 per cent. Incidentally, this substantiates the previous analysis by kinds of employment.

When all engineers reporting the field of activity are considered, the order of distribution for December 1934 is as follows: 30.4 per cent in manufacturing, 31.5 per cent in Government work, 11.8 per cent in public utilities, 9.6 per cent in construction, 8.1 per cent in personal services, and 5.1 per cent in extractive industries. For functional classification, design and research is first with 26.6 per cent, operation with 24.2 per cent, construction with 24.1 per cent, general administration and management with 8.3 per cent, consulting with 6.4 per cent, teaching with 5.9 per cent, and sales with 4.5 per cent.

There are certain well defined fields of activity for each of the professional classes. In the case of agricultural and civil engineers, it is Government work. Architectural engineers are fairly well divided between private construction and Government work; ceramic, chemical, industrial and mechanical engineers are largely concentrated in manufacturing; electrical engineers are found mostly in public utilities and manufacturing; and mining and metallurgical engineers appear mostly in the extractive, industrial,

TABLE 5

DISTRIBUTION OF ENGINEERS BY ZONES OF INTEREST AND FUNCTIONAL CLASSIFICATIONS IN THE UNITED STATES, 1934

Classification	Professional Classes									
	Agricultural		Architectural		Ceramic		Chemical		Civil	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Field of Activity										
Construction	29	9.4	91	39.4	5	1.9	32	1.4	2,148	15.4
Extractive Industries	—	—	2	.9	8	3.0	147	6.7	447	3.2
Public Utilities	13	4.3	11	4.7	1	.4	104	4.7	484	3.5
Transportation	—	—	—	—	—	—	18	.8	517	3.7
Manufacturing	21	6.8	23	10.0	231	86.8	1,592	72.0	705	5.1
Personal Service	85	27.7	11	4.7	14	5.3	171	7.7	808	5.8
Agriculture and Forestry	1	.3	—	—	—	—	—	—	—	—
Government Work *	158	51.5	93	40.3	7	2.6	148	6.7	8,812	63.3
Total	307	100.0	231	100.0	266	100.0	2,212	100.0	13,921	100.0
Total Not Reporting	90	—	307	—	122	—	1,300	—	5,970	—
Functional Classification										
Design and Research	69	22.5	72	31.2	77	28.9	727	32.9	3,030	21.8
Construction	85	27.7	102	44.1	9	3.4	48	2.1	6,368	45.7
Operation	22	7.1	13	5.7	138	51.9	1,051	47.5	1,741	12.5
Consulting †	34	11.1	17	7.3	8	3.0	95	4.3	874	6.3
Teaching	62	20.2	9	3.9	11	4.2	128	5.8	553	4.0
Sales	12	3.9	7	3.0	8	3.0	67	3.1	175	1.2
General Administration and Management	23	7.5	11	4.8	15	5.6	96	4.3	1,180	8.5
Total	307	100.0	231	100.0	266	100.0	2,212	100.0	13,921	100.0
Total Not Reporting	90	—	307	—	122	—	1,300	—	5,970	—

TABLE 5—*Continued*

Classification	Professional Classes									
	Electrical		Industrial		Mechanical		Mining and Metal		Total	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Field of Activity										
Construction	184	2.8	35	5.1	762	8.7	22	1.5	3,308	9.6
Extractive Industries	126	1.9	25	3.7	328	3.7	684	47.3	1,767	5.1
Public Utilities	2,634	39.7	60	8.8	734	8.4	19	1.3	4,060	11.8
Transportation	199	3.0	19	2.8	429	4.9	4	.2	1,186	3.5
Manufacturing	2,231	33.7	456	66.8	4,841	55.2	399	27.7	10,499	30.4
Personal Service	602	9.1	55	8.1	866	9.9	160	11.0	2,772	8.1
Agriculture and Forestry	—	—	—	—	1	‡	—	—	2	‡
Government Work *	650	9.8	32	4.7	803	9.2	160	11.0	10,863	31.5
Total	6,626	100.0	682	100.0	8,764	100.0	1,448	100.0	34,457	100.0
Total Not Reporting	4,817	—	325	—	4,462	—	739	—	18,132	—
Functional Classification										
Design and Research	1,846	27.9	92	13.5	2,960	33.8	281	19.4	9,154	26.6
Construction	717	10.8	42	6.1	841	9.6	97	6.7	8,309	24.1
Operation	2,261	34.1	229	33.6	2,271	25.9	629	43.4	8,355	24.2
Consulting †	423	6.4	67	9.8	507	5.8	161	11.2	2,186	6.4
Teaching	487	7.3	24	3.6	635	7.2	127	8.7	2,036	5.9
Sales	434	6.6	41	6.0	777	8.9	28	2.0	1,549	4.5
General Administration and Management	458	6.9	187	27.4	773	8.8	125	8.6	2,868	8.3
Total	6,626	100.0	682	100.0	8,764	100.0	1,448	100.0	34,457	100.0
Total Not Reporting	4,817	—	325	—	4,462	—	739	—	18,132	—

* Includes Federal, State, county, and municipal.
† Includes independent consultants and employees of consulting firms.
‡ Less than 1/10 of 1 per cent.

and manufacturing zones. For each of the professional classes the oustanding functional classifications are design and research, construction and operation. Specifically, however, the distribution by fields of activity and functional classifications are as follows:

Of the agricultural engineers reporting as employed on December 31, 1934, no less than 51.5 per cent were in Government work, probably due to the great demand for engineers in such work as soil erosion, irrigation, etc. Personal service * absorbed 27.7 per cent of the total, the remaining agricultural engineers being distributed in construction, manufacturing, public utilities, and private agriculture and forestry. Referring to the distribution by functional classification, 27.7 per cent of the agricultural engineers were in construction, 22.5 per cent in design and research, and 20.2 per cent in teaching, the proportions in the remaining classifications ranging from 3.9 per cent for sales to 11.1 per cent for consulting.

* Includes education, publications, professional and trade organizations, real estate, banking. insurance and wholesale and retail establishments.

The architectural engineers also found Government work the best recent possibility for employment, with 40.3 per cent so employed; 39.4 per cent were in private construction, and only 10 per cent in manufacturing, the remainder being in public utilities, personal service, and extractive industries. As regards the functional classifications, 44.1 per cent were in construction and 31.2 per cent in design and research, the range for the remaining classifications being from 3.0 for sales to 7.3 per cent for consulting.

The picture for ceramic and chemical engineers as to the fields of activity and functional classifications is somewhat similar. In each case, the largest percentage is to be noted in manufacturing, the figures being 86.8 for ceramic and 72 for chemical engineering. The number engaged in Government work was 6.7 per cent of the chemical and 2.6 per cent of the ceramic engineers. For the functional classifications, each of these two professional classes had the largest percentages in design and research and in operation.

The percentage of civil engineers employed by Governmental agencies was 63.3 in December 1934. The next highest percentage was in private organizations rendering engineering service, with 15.4 per cent of the total. This unusually large proportion in Government work is explained primarily by the almost complete cessation, during the period immediately preceding the survey, of civil-engineering opportunities in the normal fields of activity other than Government. In the distribution of the civil engineers by functional classification, construction leads with 45.7 per cent, followed by design and research with 21.8 per cent, and operation with 12.5 per cent—a total of 90 per cent in these three classifications.

As anticipated, the percentage of electrical engineers in public utilities is high, being 39.7, but it is also interesting to note that as many as 33.7 per cent reported manufacturing as their field of activity. Nine and eight-tenths per cent were in Government work, and 9.1 per cent were in personal service. Again, as in the case of civil engineers, the first three functional classifications cover 72 per cent of all reporting, although the order is operation with 34.1 per cent, design and research with 27.9 per cent and construction with 10.8 per cent.

Industrial and mechanical engineers are largely in manufacturing, 66.8 per cent of the former and 55.2 per cent of the latter being in these fields. In the case of industrial engineers, the next highest percentages were 8.8 in public utilities and 8.1 in personal service, and for mechanical engineers 9.9 in personal service, 8.7 in construction, and 8.4 in public utilities. Of the 682 industrial engineers reporting functional classification, 33.6 per cent were in operation, 27.4 per cent were in general administration and man-

agement, and 13.5 per cent were in design and research. Of the 8,764 mechanical engineers, the highest percentage, 33.8, were in design and research, while 25.9 per cent were in operation, 9.6 per cent in construction, and 8.9 per cent in sales.

Naturally, the highest percentage of mining and metallurgical engineers was in extractive industries, where 47.3 per cent were employed, although it is interesting to note that 27.7 per cent reported manufacturing as their field of activity. There were 11 per cent in personal service and the same per cent in Government work. As for the distribution by functional classification, the highest percentage appears in operation with 43.4, followed by design and research with 19.4. However, it will be seen that there is some importance attached to consulting as far as this professional class is concerned, as 11.2 per cent reported this as their functional classification.

The Income of the Engineer

The one thing that everyone is interested in is income. Two sets of data on income were obtained; the first refers to income received from salaries or personal services in both engineering and nonengineering, while the second pertains to the average monthly earnings from engineering work only.

Since the information secured on employment covered only the engineer's major occupation, it is assumed that the data furnished us are very closely related to the kind of employment reported. In certain instances this assumption is not wholly justified. Nevertheless, it is believed that in the great majority of cases these two items are closely related.

Taking the total annual income, irrespective of how it was derived, the data show that there is very little variation in the average incomes of the civil, electrical and mechanical engineers who reported. Consequently, for purposes of discussion, these three professional classes will be treated as a single unit. And since these three groups constitute the majority of the engineers covered by the survey, their earnings will be treated as more or less representative of the profession as a whole.

Considering, first, for the three groups combined, the average total annual incomes of all graduates, up to and including 1924, the income of those engineers in the employ of private firms or organizations decreased from $5,200 in 1929, to $4,200 in 1932, and to $4,100 in 1934 in contrast with $4,900 in 1929, $3,900 in 1932 and $3,700 in 1934 for the corresponding "other engineers" group. For the same groups, graduates who were in the employ of the Federal Government, the range of total earnings was

TABLE 6

AVERAGE ANNUAL INCOME OF ALL CIVIL, ELECTRICAL, AND MECHANICAL ENGINEERS FOR 1929, 1932 AND 1934

Kind of Employment	All Graduate Engineers								
	1933–1934	1930–1932		1925–1929			Prior to 1925		
	1934 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income
Private Firm or Organization	$1000	$1400	$1500	$2200	$2200	$2400	$5200	$4200	$4100
Federal Government	1200	1600	1700	2000	2200	2100	3900	3700	3300
Nonengineering Work	800	900	1200	2100	1600	1700	6400	3600	3600
Unemployed Plus Direct Relief	400	400	600	1400	1000	900	2500	1300	1100

Kind of Employment	All "Other" Engineers								
	1905–1909 * Year of Birth			1900–1904 Year of Birth			Prior to 1900 Year of Birth		
	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income
Private Firm or Organization	$2000	$1600	$1700	$2700	$2300	$2400	$4900	$3900	$3700
Federal Government	1500	1800	1600	2000	2000	1900	3300	3100	2800
Nonengineering Work	1400	1100	1300	2400	1600	1700	4400	2800	2700
Unemployed plus Direct Relief	—	700	600	2200	800	700	2400	1100	900

* 1910–14 year of birth group not shown because of small number reporting income.

from $3,900 in 1929 to $3,700 in 1932 and to $3,300 in 1934; but for "other engineers" the averages were much lower, ranging from $3,300 in 1929 to $3,100 in 1932 and to $2,800 in 1934. For members of these two groups engaged in nonengineering work there was a marked decrease in income during the period covered. The range for the graduates was from $6,400 in 1929 to $3,600 in 1932 and 1934, whereas, the "other engineers" ranged from $4,400 in 1929 to $2,800 in 1932 and to $2,700 in 1934. Finally, the ranges for both the graduates and "other engineers" reporting as being wholly unemployed in December of 1929 and 1934, were virtually identical. In each instance the drop was from $2,500 in 1929 to $1,200 in 1932, and to $1,000 in 1934.

The combined annual income of civil, electrical and mechanical engineers in the graduating classes of 1925–29, who were in the employ of private firms averaged $2,200 in 1929. It is surprising to note that this group of graduates actually experienced an increase in income in 1934 as compared with 1929, the rise being from $2,200 to $2,400. However, in the case of the corresponding

"other engineers" group, *i.e.*, those born in 1905–09, there was a decrease over the same period from $2,000 to $1,700.

The average income for both graduates and "other engineers," in the employ of the Federal Government, remained fairly stable, the average for graduates being $2,100 and $1,700 for "other engineers." For nonengineering work the graduate group dropped from $2,100 in 1929 to $1,700 in 1934, whereas the "other engineers" dropped from $1,400 to $1,300 over the same period; and for those who reported as being wholly unemployed at the end of each of these two years, the average income of the graduates ranged from $1,400 in 1929 to $900 in 1934, while the average for "other engineers" in 1934 was only $600.

Since the recent groups of graduates, that is, the 1930–32 and 1933–34 classes, had no engineering status in 1929, comparison can be made only for the years 1932 and 1934. Between 1932 and 1934, the 1930–32 graduates showed a very slight increase in their average income, the figures for 1934 being: for private firms, $1,500; for Federal Government, $1,700; for nonengineering work, $1,200; and for those wholly unemployed at the end of 1934, $600 per annum. By comparison, the average income in 1934 for the 1933–34 graduates was as follows: private firm, $1,000; Federal Government, $1,200; nonengineering work, $800; and wholly unemployed $400.

In contrast with the average *total annual* income is the average *monthly* income received from engineering work only while employed on engineering operations. A comparison of the combined civil, electrical and mechanical engineers shows that the graduates had a decided advantage, particularly the older graduates. For those who graduated up to and including 1924, the average monthly income fell from $420 in 1929 to $350 in 1934. For the "other engineers," of comparable age the average was from $410 in 1929 and $310 in 1934. For employees of the Federal Government, the average monthly income declined from $320 in 1929 to $280 in 1934 for graduates as compared with a drop from $280 in 1929 to $240 in 1934 for the "other engineers." The average monthly income from engineering work of those who reported to be on nonengineering work at the end of each of the years 1929, 1932 and 1934 declined from an average of $380 in 1929 to $260 in 1934 for graduates. The "other engineers" reported an average monthly income of $360 in 1929 and only $230 in 1934. Similar average monthly declines were shown for those who were reported as being unemployed at the end of each year.

The analysis of the monthly incomes derived from engineering by the younger engineers shows that the changes between 1932 and 1934 were negligible. Those who graduated between 1925 and 1929

averaged $190 a month in private employment and $180 in Federal Government employ in 1929. These same average rates applied in 1934. In other words, the cumulative effect of the depression was such as almost exactly to offset the increased experience of five years of work that would normally lead to an opportunity to raise earnings. In contrast the "other" engineers (those without engineering degrees) who fell in the age groups corresponding to that of 1925–29 graduates had substantially smaller average earnings in 1934 than in 1929. Their average engineering income dropped from $230 monthly in private employment in 1929 to $200 in 1934, and from $220 to $170 in federal employment.

TABLE 7

AVERAGE MONTHLY INCOME FROM ENGINEERING WORK FOR ALL CIVIL, ELECTRICAL, AND MECHANICAL ENGINEERS FOR 1929, 1932 AND 1934

Kind of Employment	All Graduate Engineers								
	1933–1934	1930–1932		1925–1929			Prior to 1925		
	1934 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income
Private Firm or Organization	$120	$130	$140	$190	$190	$190	$420	$370	$350
Federal Government	130	150	150	180	190	180	320	300	280
Nonengineering Work	100	110	110	170	150	160	380	230	260
Unemployed plus Direct Relief	110	120	110	110	180	290	300	230	220

Kind of Employment	All "Other" Engineers								
	1905–1909* Year of Birth			1900–1904 Year of Birth			Prior to 1900 Year of Birth		
	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income	1929 Income	1932 Income	1934 Income
Private Firm or Organization	$170	$150	$150	$230	$200	$200	$410	$330	$310
Federal Government	130	140	150	220	180	170	280	260	240
Nonengineering Work	120	110	110	260	180	170	360	230	230
Unemployed plus Direct Relief	—	130	110	200	160	150	310	210	190

* 1910–14 year of birth group not shown because of small number reporting income.

From this discussion of the engineers' income and earnings, it is quite apparent that even in a time of depression the graduate engineer earns more than those engineers who have not pursued a regular course of study. However, it is significant to note that the younger "other engineers" earn more than the graduates. That is to say, the young engineer of 23 or 24 finds a higher immediate market value placed on "experience" than on education.

Preliminary analysis indicates that the nongraduates reach their highest salary levels before the graduates, after which their salary curve begins to flatten out, while that of the graduates continues to rise. Among older engineers the advantage of higher average income goes clearly to the graduate engineer. To illustrate, the average monthly income of the 1925–29 graduates was $190 in 1929 as compared with $230 for the year-of-birth group of 1900–04 of the "other engineers." For Federal Government employees, the corresponding comparative figures were $180 for graduates and $220 for "other engineers." A similar differential prevailed in private employment in 1932 and 1934 with regard to recent graduates. But among engineers who had been out of college for five years or more in 1929, the average income was $420 for graduates in private employment and $410 for "other engineers." By 1934, in private employment the spread had become $350 for graduates and $310 for "other engineers."

Summary

The number of returns is an indication of the engineer's genuine interest in his profession. Not only were the number of returns a most gratifying response, but their distribution throughout the country and among the several professional classes has made it possible for us to present material which can be used to aid in solving the many problems with which you are confronted. This is especially important, considering the fact that the survey covered a very acute depression period, the effects of which has raised grave doubts in the minds of the members of your profession as to the efficacy of an engineering education and its relation to all professional activity.

As for the results obtained from the analysis of the educational data, it is believed that the information will be of value to (1) engineering educators, (2) to younger engineers in the way of guidance, and (3) to the experienced engineer, who is ever anxious to know where he stands in relation to the other members in his profession.

The first important fact derived from the discussion of the educational data is that engineering is primarily a profession of experience. To be sure, there are some exceptions, as for example, in the professional classes of agricultural, ceramic, and chemical engineering where it was noted that postgraduate work appeared to be extensive; but on the whole, the question of education in engineering appears to be important only through the first degree, after which it is experience plus the make-up of the individual engineer that counts.

A second fact worthy of comment is that there has been a marked decrease in the number of engineers in the profession who have not completed their college education. There are several factors to be considered in explaining this, particularly the availability of education in the United States. Whatever the reason may be, however, it appears that professional engineering status in the future will not be easily attained without a complete college education.

A third item worthy of emphasis is that no professional class escaped the effects of the depression. There was, however, a distinct line of demarcation between the employment experience of civil, electrical and mechanical engineers. The very fact that in all classes of graduates and "other engineers" the civil engineers found Federal Government the best field of employment, while the other two classes only showed slight increases in that kind of employment, has important implications for your profession. Fourth, it seems that as far as employment with private firms is concerned, the "other engineers" have fared better than the graduates during the depression.

When the data on employment are related to unemployment, however, the picture looks different. The data show that the graduate engineers had a shorter average period of unemployment than the "other engineers" group in the profession.

Similarly, with regard to income, even during the depression the graduate engineers fared better than the "other engineers," and that in two ways; first, the percentage decreases from 1929 to 1934 were not so great as those for the "other engineers"; and, second, the older graduate engineers maintained a differential in salaries over the "other engineers." As has been shown from previous surveys, and again in this one, the difference in the upper limit of salaries for graduates and "other engineers" is large. That is to say, while education slows up the possibility of obtaining a comparatively large salary, it appears that the graduate engineers, in the long run, earn more than those who did not complete a full college course.

It should be emphasized that I have only presented summary figures at this time. In the course of the next few months, the detailed data will be available. The task still ahead of us is large. I submit for your serious consideration the making of arrangements whereby the data in the survey can be further sifted and refined in order that more complete information may be made available.

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WAGNER, WILLIAM C., Assistant Professor of Civil Engineering, University of New Mexico, Albuquerque, N. M. W. E. Farris, J. H. Dorroh.

WALTER, HAROLD E., Associate Professor of Mechanical Engineering, Newark College of Engineering, Newark, N. J. F. D. Carvin, P. E. Schweizer.

WILKINSON, FORD L., Professor of Mechanical Engineering, University of Tennessee, Knoxville, Tenn. Chas. E. Ferris, G. E. Tomlinson.

WILSON, WARREN E., Instructor in Civil Engineering, State School of Mines, Rapid City, S. D. C. G. Watson, E. E. Clark.

WIMMER, GLEN E., Instructor in Mechanical Engineering, Michigan College of M. & T., Houghton, Mich.

ZERVIGON, MARIO G., Instructor in Electrical Engineering, Tulane University, New Orleans, La. J. M. Robert, C. W. Ricker.

61 new members

COMMITTEES FOR 1936–37

Executive: H. P. Hammond, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., I. C. Crawford, Sada A. Harbarger, F. L. Bishop and W. O. Wiley.

Publication: F. L. Bishop, Chairman, University of Pittsburgh, Pittsburgh, Pa., H. P. Hammond and D. S. Anderson.

Program: H. P. Hammond, Chairman, I. C. Crawford, Sada A. Harbarger, F. L. Bishop and W. O. Wiley.

Conferences: I. C. Crawford, Chairman, University of Idaho, Moscow, Ida., P. H. Daggett, R. L. Sweigert, F. L. Plummer and P. T. Norton.

Institutional Members: R. A. Seaton, Chairman, Kansas State College, Manhattan, Kansas, D. C. Jackson and R. L. Sackett.

Relations with Engineering Societies: R. I. Rees, Chairman, 195 Broadway, New York City, D. C. Jackson, A. H. White, A. H. Fuller, W. B. Plank and F. L. Bishop.

Instructional Standards: H. S. Rogers, Chairman, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., T. M. Focke, H. P. Hammond, W. C. John, H. H. Jordan and Morland King.

Engineering Economy: E. L. Grant, Chairman, Stanford University, Calif., G. W. Barnwell, Walter Rautenstrauch, J. W. Roe, J. W. Hallock, Hugo Diemer, E. D. Ayres, L. R. Guild, W. E. Hotchkiss, W. D. Ennis.

Engineering Research: F. T. Mavis, Chairman, University of Iowa, Iowa City, B. R. Van Leer, O. G. C. Dahl, E. R. Weidlein, Ernst Weber, H. J. Gilkey, R. C. Ernst, W. E. Milligan and J. H. Weaver.

Graduate Study: T. R. Agg, Chairman, Iowa State College, Ames, Erich Hausmann, Harold Pender, E. L. Moreland, W. C. John, Hardy Cross, W. N. Jones, S. C. Lind, F. O. McMillan, and E. C. Thomas.

Professional Status and Employment of Engineering Graduates: John R. Bangs, Chairman, Cornell University, Ithaca, N. Y., R. M. Barnes, M. M. Boring, R. I. Rees, J. E. Walters, K. L. Wildes.

Orientation of Freshmen: A. R. Cullimore, Chairman, College of Engineering, Newark, N. J., H. H. Armsby, R. M. Ihrig, F. C. Dana, E. R. Wilcox, A. D. Moore, A. V. Millar, W. E. Duckering and P. C. Nash.

Comprehensive Examinations: C. V. Mann, Chairman, Missouri School of Mines, Rolla, Mo., Paul Cloke, F. G. Higbee, F. V. Larkin, A. W. Leighton, Justus Rising, W. H. Timbie, G. B. Thom, Ben D. Wood, J. E. Walters and E. R. Wilcox.

Junior Colleges: W. E. Wickenden, Chairman, Case School of Applied Science, Cleveland, Ohio, E. B. Norris, F. C. Bolton, H. C. Sadler, H. B. Dirks, R. A. White, A. H. Gehrig, C. A. Anderson and F. O. Rose.

English: E. C. Elliott, Chairman, Purdue University, Lafayette, Ind., H. L. Creek, K. O. Thompson, Harold Burris-Meyer, John Mills, W. O. Sypherd, J. L. Vaughan, A. M. Greene, O. J. Ferguson, John G. Bowman and H. S. Rogers.

Industrial: P. T. Norton, Chairman, Virginia Polytechnic Institute, Blacksburg, Va., John Younger, H. B. Hastings, A. S. Knowles, M. A. Lee, F. A. Magoun, D. B. Porter, R. M. Barnes, G. H. Shepard, and C. E. Bullinger.

Mechanical: B. M. Brigman, Chairman, University of Louisville, Louisville, Ky., H. L. Solberg, C. H. Casberg, R. M. Barnes, F. L. Eidmann, R. L.

Sweigert, B. G. Elliott, F. D. Carvin, Alvin Sloane, C. E. Davies, W. R. Woolrich, F. W. Marquis and L. G. Miller.

Mining and Metallurgy: W. B. Plank, Chairman, Lafayette College, Easton, Pa., T. T. Read, E. A. Holbrook, C. E. Locke, Bradley Stoughton, F. A. Thomson, C. H. Mathewson and O. E. Harder.

Progress: C. F. Scott, Chairman, Yale University, New Haven, Conn., H. V. Carpenter, F. C. Bolton, S. B. Earle and P. W. Ott.

Physics: D. S. Elliott, Chairman, Tulane University, New Orleans, La., P. B. Fraim, W. L. Severinghaus, O. M. Stewart, N. E. Wheeler, G. E. Grantham, E. E. Bortell, W. N. St. Peter and H. S. Hower.

Two-year Terminal Program: B. R. Van Leer, Chairman, University of Florida, Gainesville, Fla., R. E. Doherty, B. F. Bailey, J. W. Barker, C. M. Jansky, E. A. Hitchcock, Louis O'Shaughnessy and P. R. Kolbe.

Sections and Branches: G. W. Case, Chairman, University of New Hampshire, Durham, N. H., R. H. Spahr, L. L. Vaughan, F. M. Dawson, L. M. K. Boelter and J. R. Morgan.

M. K. S. System of Units: Edward Bennett, Chairman, University of Wisconsin, Madison, Wis., E. V. Huntington, S. S. Attwood, G. B. Pegram, W. L. DeBaufre and E. R. Hedrick.

Lamme Award: E. B. Roberts, Chairman, Westinghouse E. & M. Co., East Pittsburgh, Pa.; for four years, G. W. Case, University of New Hampshire, W. E. Freeman, University of Kentucky, H. S. Evans, University of Colorado; for three years, E. B. Roberts, Geo. B. Thomas, 463 West St., New York City, Frederic Bass, University of Minnesota; for two years, D. B. Prentice, Rose Polytechnic Institute, R. W. Sorenson, California Institute of Technology, S. C. Hollister, Cornell University; for one year, J. R. Nelson, University of Michigan, C. F. Harding, Purdue University, A. R. Cullimore, Newark College of Engineering.

Membership: H. P. Hammond, Chairman, W. J. Creamer, E. W. Bowler, F. W. Garran, G. F. Eckhardt, A. E. Winslow, A. L. Townsend, C. L. Dawes, F. H. Crabtree, C. S. Ell, G. H. MacCullough, W. W. Edwards, J. A. Hall, C. D. Billmyer, R. H. Suttie, F. L. Eidmann, D. B. Porter, Wm. Allan, G. F. Bateman, Bro. A. Leo, J. A. Lambertine, W. H. H. Cowles, G. E. Grantham, F. C. Wilson, J. W. Gavett, R. A. Hall, L. H. Means, Louis Mitchell, R. P. Baker, C. W. Barnwell, N. P. Bailey, R. W. Van Houten, J. C. Elgin, R. L. Spencer, Hale Sutherland, W. S. Lohr, H. A. Shafer, W. H. Kavanaugh, R. C. Disque, L. C. McCandliss, H. M. McCully, C. E. Bullinger, S. B. Lilly, C. T. Humphrey, J. R. Lapham, E. A. Valade, J. C. Gray, A. G. Christie, S. S. Steinberg, W. S. Rodman, Louis O'Shaughnessy, J. A. Anderson, G. P. Boomsliter, J. W. Harrelson, W. J. Seeley, H. G. Baity, R. L. Sumwalt, S. B. Earle, L. S. LeTellier, D. P. Savant, N. C. Ebaugh, J. M. Gallalee, M. L. Freeman, A. D. Taylor, L. J. Lasselle, J. M. Robert, W. E. Freeman, W. B. Wendt, E. L. Carpenter, F. J. Lewis, F. C. Caldwell, F. L. Plummer, H. L. Solberg, C. W. Park, F. S. Griffin, D. M. Palmer, Father Steiner, A. D. Moore, H. B. Dirks, H. W. Risteen, C. J. Freund, R. P. Hoelscher, W. C. Smith, E. H. Freeman, A. T. Child, D. C. Jackson, Jr., F. E. Johnson, H. H. Armsby, E. O. Sweetser, A. H. Fuller, F. M. Dawson, B. G. Elliott, L. G. Straub, D. R. Jenkins, R. M. Dolve, H. M. Crothers, E. E. Clark, J. W. Haney, R. G. Kloeffler, G. J. Hood, W. N. Gladson, H. L. Dodge, H. G. Thuesen, L. E. Grinter, W. R. Woolrich, O. V. Adams, J. H. Pound, E. H. Flath, F. M. Warner, H. V. Carpenter, W. M. Cobleigh, F. A. Thomson, R. D. Goodrich, J. H. Johnson, W. O. Birk, A. S. Adams, E. B. House, T. C. Adams, J. A. Carpenter, H. M. Milton, S. B. Talmage, M. E. Farris, J. C. Park, H. B. Langille, P. S. Biegler, G. H. Hunt, R. W. Sorenson, C. A. Mockmore, A. B. Domonoske, C. R. Young, C. M. McKergow.

NECROLOGY

JAMES ALEXANDER HALL, professor of mechanical engineering at Brown University, died October 29, 1936, after a month's illness. He was forty-eight years old. Professor Hall was born in Berlin, Vt., the son of John Joseph and Agnes Brock Hardie Hall, and received the Bachelor of Science degree from Brown in 1910, when he first joined the faculty.

He was consulting engineer for the Brown & Sharpe Manufacturing Company for the last ten years. He was a fellow of the American Association for the Advancement of Science, of the American Society of Mechanical Engineers and of the Society for the Promotion of Engineering Education.

WILLIAM A. HILLEBRAND, Professor of Electrical Engineering at the University of California, died after a short illness, July 24, 1936. Profesor Hillebrand was born October 9, 1882. He received his A.B. at Cornell in 1905, after which he studied at Stanford University for a year. He was with the Western Electric Company of San Francisco and Los Angeles for a short time, and then taught at Stanford until 1911. From there he went to Oregon State College where he was Professor and Executive of the Electrical Engineering Department until 1914. Profesor Hillebrand was Assistant Engineer for the Pacific Gas and Electric Company until 1918, and for the Federal Telegraph Company of Palo Alto until 1919. He was with the Ohio Brass Company from 1919 to 1932 as Sales Engineer, Electrical Engineer, and Consulting Engineer. In 1932 he became Professor of Electrical Engineering at the University of California, which position he held until his death.

Professor Hillebrand was a member of Eta Kappa Nu, Sigma Xi, the American Institute of Electrical Engineers, the Institute of Radio Engineers, the Society for the Promotion of Engineering Education, and the Schweizerischer Elektrotechnischer Verein of Zurich.

FREDERIC OZANAM XAVIER MCLOUGHLIN was born in New York, N. Y., on March 12, 1888, and attended the public schools of that city. He earned his Bachelor of Science degree at The City College, New York City, in 1909. In 1913, he took his Civil Engineer-

ing degree at Columbia University, and in the following year, was awarded the degree of Master of Arts in Highway Engineering by the same institution.

Professor McLoughlin was a teacher at The College of the City of New York from 1910 until his death June 28, 1936. He rose to the rank of Instructor in 1916, was made Assistant Professor in 1918, Associate Professor in 1925, and Professor in 1934.

At The City College he was Secretary of the Faculty of The School of Technology from the time of its founding until his death, and served as a member of the City College Co-Operative Store Committee. He established and organized the Summer Surveying Camp, founded and developed the Evening Courses in Building Construction, organized post-graduate courses in Highway Engineering, and was Chairman of the Curriculum Committee. He was the author of a Field Manual in Elementary Surveying, which is used in the Elementary Surveying Course at the College.

The **Case School of Applied Science** has sustained a heavy loss in the recent death of Professor Frank H. Neff, a member of the faculty for 44 years, professor emeritus since 1931.

After his graduation in 1887, from Case, he became instructor in mathematics and civil engineering. At the end of a year he resigned and, going to Europe, continued his studies at the Ecole des Ponts et Chausee and at the Sorbonne in Paris, France. Upon his return to this country a year later, he was made instructor of French and civil engineering at Case. In 1891 he became assistant professor, and in 1897 full professor of Civil Engineering and head of that department. At the time of his retirement, Professor Neff was the oldest professor in years of service for the college.

Throughout most of the life of Case School, Professor Neff was closely associated with its development. He attended the first commencement of the college, and after his graduation at the third commencement he became an instructor. For more than 30 years Professor Neff served as treasurer of the athletic association; he was also treasurer for the college newspaper staff, *The Case Tech.* For a great many years he was custodian of the student loan funds, assisting many students in financing their way through college.

Professor Neff's colleagues, alumni of the college, and his personal friends, have often cited his devotion to his work as a good teacher, his meticulous supervision of design in the drafting rooms, and his development of the courses in civil engineering as his marked achievements.

Early in this century, Professor Neff formed The Electric Rail-

way Improvement Company of Cleveland, and until his death he was head of the company.

Since 1931 he had been in ill health, but for much of the time he was able to attend college reunions and commencement exercises, as well as to stop at the college to chat with former colleagues. At the time of his death, Professor Neff was 71.

Clubs and organizations to which Professor Neff belonged include: American Society of Civil Engineers; American Society for Testing Materials; American Railway Engineering Association; Cleveland Engineering Society; Society for the Promotion of Engineering Education; the University and Rowfant Clubs of Cleveland; Sigma Xi; and Zeta Psi.

H. R. YOUNG,
Assistant Professor of English

ALFRED MCLARREN WHITE was born July 1, 1904, and died September 23, 1936. Dr. White was a son of Alfred H. White, Professor of Chemical Engineering at the University of Michigan. He was educated at the University of Michigan, B.S.E., 1925 (Major subject Chemical Engineering); M.S., Univ. of California, 1926 (Major subject Chemistry); Sc.D., Univ. of Michigan, 1928 (Major subject Chemical Engineering).

He was Assistant Professor of Chemical Engineering, Georgia School of Technology, 1928–30; Associate Professor of Chemical Engineering, Univ. of North Carolina, 1930–36 and Head of Department of Chemical Engineering 1934–36; Head of Department of Chemical Engineering, Univ. of Virginia, June 1936. He did not live to begin his duties at the University of Virginia.

Dr. White was a member of the American Institute of Chemical Engineers, American Chemical Society, Society for Promotion of Engineering Education, Elisha Mitchell Society of the University of North Carolina. He was Chairman of Chapel Hill Choral Club and a member of the chorus; Member of the University Symphony Orchestra; Composer of one symphony and minor pieces. He was successful enough in water colors so that his pictures have been accepted at several local exhibitions.

THE 1936–37 YEAR BOOK

For the purpose of checking the accuracy of the entry which appears after your name in the year book, will you kindly send, immediately, the following information to F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.:

Name .....
(last) (first) (middle).

Title of position .....
(department)

Institution .....

(Address) .....

Occupational Classification .....

COLLEGE NOTES

Armour Institute of Technology.—The following personnel changes and additions to our instruction staff may be of interest: Earl H. Reed, Director of the Department of Architecture, has resigned to devote all of his time to the practice of his profession, and is succeeded by Louis Skidmore. Jerrold Loebl has been appointed Assistant Director, and Stirling H. Harper, Instructor in Architectural Construction. Mr. Skidmore is a graduate of Massachusetts Institute of Technology, was a student at Beaux Art and at the Academy of Rome, organized the architectural staff and was Chief of Design for A Century of Progress Exposition in 1933, becoming for 1934 Assistant General Manager of the Fair in charge of all design and construction. Mr. Loebl, Armour 1921, has been a successful practicing Architect in Chicago.

Additions to the faculty include:

Mechanical Engineering: William J. McLarney, B.S., Iowa; M.A., Columbia, Instructor.

Electrical Engineering: J. E. Hobson, B.S., M.S., Purdue; Ph.D., Calif. Institute of Tech., Instructor; Earle L. Kent, B.S., M.S., Kansas State, Instructor.

Chemical Engineering: Ralph H. Manley, B.A., Beloit; M.A., Illinois; Ph.D., Illinois, Instructor; John A. Schaad, B.S., Illinois; Ph.D., Ill., Instructor; Otto Zmeskal, B.S., Armour, Instructor in Metallurgy.

Mathematics: H. A. Giddings, B.A., New Hampshire; Ph.D., Massachusetts Institute of Technology, Assistant Professor; G. Cuthbert Webber, B.A., M.A., British Columbia; Ph.D., Chicago, Instructor.

Fire Protection Engineering: J. T. Sorenson, B.S., Armour, Instructor in Insurance.

Dr. Thomas C. Poulter has been appointed Director of the recently organized Research Foundation of Armour Institute of Technology.

Education:

Iowa Wesleyan College, B.S., 1923.

University of Chicago, graduate student, 1923–25; Ph.D. in Chemistry, 1933.

Iowa Wesleyan College, Sc.D. (Honorary), 1935.

Teaching:

Iowa Wesleyan Academy, Professor of Physics, 1916–18.
Iowa Wesleyan College, Assistant in Biology, Chemistry, and Physics, 1923.
University of Chicago, Assistant in Chemistry, 1923–25.
Iowa Wesleyan College, Head of Dept. of Chemistry, 1925–27; Head of Dept. of Physics, 1927–33; Head of Division of Physical Science, Mathematics and Astronomy, 1933.

Research:

University of Iowa, 1931.
Arizona Meteor Expedition, 1932.
Guggenheim Fellow, 1933–34.
Second Byrd Antarctic Expedition, in charge of scientific work, second in command of Expedition, 1933–35.

Principal Research Subjects:

Electrical chemical, physical, and optical effects of extremely high pressure.
Antarctic meteor and auroral phenomena.
Geophysics; glaciology; seismology; terrestrial magnetism.
Organic chemistry.

Scientific Societies:

American Physical Society; American Chemical Society; American Polar Society; Seismological Society of America; American Association for the Advancement of Science; Sigma Xi.

Dr. Poulter comes to us with exceptional recommendations from authorities in research and in education, and from Admiral Byrd. His record shows unusual ability in the design and construction of scientific instruments, including all of the equipment used in his high pressure research. His commander in the Antarctic writes of him, "I found his work and his personality so outstanding that I appointed him second in command."

Colorado State College.—The only change that has taken place this year is that Dr. Dudley P. Craig has taken the position of Head of the Department of Mechanical Engineering. This fills the vacancy left by the retirement of Professor L. D. Crain. Mr. Craig was formerly Associate Professor of Mechanical Engineering at Purdue University.

Connecticut State College.—We have added another man to our faculty with the rank of instructor—Mr. Richard C. Turner, Master of Science in Electrical Engineering, Massachusetts Institute of Technology, 1928. Mr. Turner is teaching power courses in electrical engineering.

There has been a small addition to the engineering building to house our heavier electrical machinery laboratory. In addition to the equipment we already had several motor generator sets and switchboards have been added.

In our hydraulics laboratory work we have added a centrifugal pump run by an electric dynamometer and a small Weir tank connected to a circulating system with a Venturi meter and weighing tanks.

Our library facilities in engineering have been enhanced by the addition of several hundred more books on engineering than our usual number of additions. Also, there has been added to our periodical list a number of foreign and domestic magazines on engineering subjects.

The Board of Trustees and the President of the college have published a program for the development of the college in which engineering is given the first divisional consideration. Under this plan the General Assembly of the state is being asked to make an appropriation for engineering at Connecticut State College with which to build a new building of generous proportions and to equip it completely with the necessary engineering apparatus.

Cornell University.—During the course of the summer, several resignations were accepted from members of the faculty of the College of Engineering. These voluntary departures not only mark the rise of employment in business, but as well offer an opportunity essential to every successful faculty, that of bringing in new blood.

One of the first to tender his resignation was assistant Professor K. D. Wood, of the Mechanics of Engineering Department. For the past term, while he was enjoying his sabbatic leave, Professor Wood spent his time in San Diego as consulting engineer for the Consolidated Aircraft Corporation. He has now severed all relations here and will remain permanently in San Diego.

Professor Wood will be remembered for the work he did in the development of the aeronautical courses offered here. He constituted the entire department, organizing the courses, writing several textbooks for use therein, and teaching as well.

Another man to leave the staff was Roland L. Roy, Instructor in Industrial Engineering. Mr. Roy, who only recently transferred from instructing in the Electrical Engineering school, accepted a position with the Palm-Olive Peet Company in Newark, New Jersey. There he will handle industrial organization and time study work.

Arne Wikstrom, Instructor in Electrical Engineering received an appointment as Assistant Professor of Electrical Engineering at the University of Maryland.

Earl V. Hawkins, has been added to the faculty in the position of Instructor of Hydraulics. Mr. Hawkins was graduated from the University of Washington in 1934 and has since done graduate work at Cornell.

Another addition to the faculty in the Civil Engineering School is in the person of Professor Wm. E. Stanley who has been appointed Professor of Sanitary Engineering. Since the war he has been a member of the firm of Greely & Hanson, consulting Sanitary Engineers of Chicago, Illinois. Prior to the war, Professor Stanley was on the faculty of Purdue University. He is a graduate of the University of Kansas, and holds a Master's degree from Purdue.

University of Delaware.—The new $350,000 building to house Chemistry and Chemical Engineering is well under way, and will be completely finished and equipped for the next college year. One new appointment to the teaching force is made in the election of Mr. Arthur M. G. Moody, A.B. and M.E. Princeton University, as Instructor in Mechanical Engineering to fill the place of Mr. Maurice Munger, who resigned to accept a position with the N. A. C. A. Our plans for research work include a series of tests showing the effect of impact load on reinforced concrete floor slabs, under the direction of Professor T. D. Mylrea, Head of the Division of Civil Engineering, and carried on under the supervision of the National Research Council. Enrollment in the School of Engineering and in the University as a whole is the largest in the history of the institution.

Fenn College.—New members appointed to faculty: Vasily Prian, Instructor, 1926–31, Harbin Polytechnic Institute. June, 1931, Bachelor of Science degree, with dual majors: (*a*) Mechanical Engineering, (*b*) Electrical Engineering. 1931–35, University of Michigan, College of Engineering, June, 1932, obtained Master's degree. June, 1935, obtained Ph.D. degree. January-November, 1935, Efficiency Engineer with the Peninsular Paper Company, Ypsilanti, Michigan; six months with the Eastern Chinese Railway. Is now teaching Calculus, Industrial Engineering, and Production Laboratory.

William Patterson, Instructor, 1932, Wittenberg College, Springfield, A.B. degree. 1933 M.A. degree, Ohio State University, and 1936, Ph.D. degree, Ohio State University, 1933–36, Teaching fellowship in Mathematics at Ohio State University. Is now teaching Mathematics Seminar, Calculus.

Chester A. Tudbury, Instructor, 1930–34, Massachusetts Institute of Technology. December, 1934, Bachelor of Science and Master of Science in Electrical Engineering. April, 1935 to Sept., 1936, Junior Electrical Engineer in the New England Power Engi-

neering and Service Corporation, Worcester, Massachusetts, evening instructor at Wentworth Institute, Boston. Was a substitute instructor at M. I. T., 1934–35, while doing graduate work. Is now teaching Elems. of E. E., Elec. Design, Industrial Electricity Lab., Elements of Electrical Engineering Laboratory.

Robert F. Yeager, Instructor, 1926–27, Majored in Agriculture at Pennsylvania State, 1931–34, University of Alabama, June, 1934, Bachelor of Science degree in Chemical Engineering. 1936, Education work at Albright College. 1928–30 and 1934–35 at the Reading Steel Casting Company, Reading, Penna. 1927–28 and 1935–36 at the Carpenter Steel Company, Reading. Is now teaching General Metallurgy, Chemistry, Chemistry Laboratory, and Physical Chemistry Laboratory.

John H. Dyer, Instructor, 1926–32, Antioch College; 1933–36, University of Cincinnati. 1933–34, Laws Fellowship, 1934–35, Hanna Fellowship, 1935–36, Laws Fellowship. 1926–27, Robbins & Myers, Springfield, Ohio; 1927–30, Bell Telephone Laboratories, New York City; 1930–32, Antioch College; 1935–36, Instructor Physics, Physics Lab. at University of Cincinnati. Is now teaching Physics and Mathematics.

University of Illinois.—The following persons resigned their positions at the end of the past school year to accept appointments elsewhere: H. M. Westergaard, Professor of Theoretical and Applied Mechanics, to accept the Gordon McKay Professorship of Civil Engineering at Harvard University; F. W. Stubbs, Jr., Assistant Professor of Civil Engineering, to become Professor of Civil Engineering and Head of the Department, at Rhode Island State College; E. E. Ambrosius, Associate in Mechanical Engineering, to become Assistant Professor of Mechanical Engineering at the University of Oklahoma; C. L. Thompson, Associate in Ceramic Engineering, to join the staff of the Harbison-Walker Refractories Company at Pittsburgh; and P. E. Nielson, Associate in General Engineering Drawing, to engage in WPA work at Marion, Illinois.

Several new members received appointments to the staff of the College of Engineering effective the beginning of the school year, among whom were the following: Dr. C. P. Kittredge, Assistant Professor of Theoretical and Applied Mechanics; H. P. Evans, Jr., Associate in Civil Engineering; C. G. Harman, Instructor in Ceramic Engineering; J. G. Clark, Instructor in Civil Engineering; S. H. Pierce and R. K. Vierck, Instructors in General Engineering Drawing; and H. L. Godeke, Assistant in Mechanical Engineering.

Dr. V. P. Jensen is serving as Special Research Assistant Professor of Theoretical and Applied Mechanics, on leave from Iowa State College for the current year, to make special study and in-

vestigation of reinforced-concrete slabs for the Engineering Experiment Station.

Professor Jakob Kunz of the Department of Physics, and Professor E. E. Bauer, of the Department of Civil Engineering, returned to the College of Engineering after a leave of absence during the last half of the past school year. Professor Kunz travelled in Europe and Professor Bauer studied at Harvard University in the field of Soil Mechanics. Dr. J. H. Bartlett, Jr., Assistant Professor of Physics, is on leave of absence for the current school year to engage in study at Princeton University.

The new metallurgical building, appropriation for which was made last year, has been completed, and the equipment is being installed for laboratory and other purposes. Professor A. C. Callen, Head of the Department of Mining and Metallurgical Engineering, was elected President of Kiwanis International at its summer meeting in Washington, D. C.

Professor C. W. Parmelee, Head of the Department of Ceramic Engineering, was granted the honorary degree of Doctor of Science by Rutgers University at its commencement exercises in June.

The University of Kansas.—The death of George C. Shaad, who had been Dean of the School of Engineering and Architecture since 1927, leaves the school without a titular head. Until a dean is appointed, the functions of the office will be carried out by an Executive Committee, which has been appointed for that purpose, under the chairmanship of Professor F. A. Russell of the Department of Civil Engineering.

Professor Robert Warner, who spent last year as an exchange professor at Massachusetts Institute of Technology, has returned to Kansas, and has been made chairman of the Department of Electrical Engineering.

The staff of the Geology Department at **Lehigh University** has been increased to five men by the addition of Robert D. Butler. A corresponding increase in the curriculum of the department is thus possible. Butler, who received his training at the Massachusetts Institute of Technology under Professor Waldemar Lindgren, in addition to teaching mineralogy, will place special emphasis on the study and interpretation of polished surfaces of ore minerals.

University of Maine.—Edward Jones Allen has been appointed Dean of the College of Arts and Sciences to fill the position left vacant by Dean James Muilenburn, who resigned this summer to take a position in the Pacific School of Religion in Berkeley, California. Percy F. Crane, formerly Senior-Master, Gould Academy, Bethel, Maine, has been appointed Director of Admissions and will continue the work of Dean J. N. Hart who is on leave of absence. W. E. Bradt, Assistant Professor of Chemistry at the State College

of Washington, Pullman, Washington, has been appointed Professor of Chemistry and head of the department of Chemistry and Chemical Engineering. Alexander C. Lendo of Otter River, Mass., a graduate of Worcester Polytechnic Institute in the class of 1933, has been appointed Assistant in the department of Civil Engineering. Ralph A. Sawyer of the department of Engineering Drafting has been promoted from the rank of Instructor to that of Assistant Professor. L. C. Jenness of the department of Chemistry and Chemical Engineering is pursuing graduate work in chemical engineering at Massachusetts Institute of Technology during this current academic year. Earl M. Dunham of the department of Engineering Drafting is doing graduate work at the Harvard School of Business Administration. C. C. Tyrrell, Instructor in the department of Mechanical Engineering, spent the summer with the Textile Engineering Company of Lewiston, Maine. W. H. Bliss, Instructor in Electrical Engineering, attended the Summer Session at Purdue University.

The curriculum in Chemical Engineering has been materially altered to include courses in Unit Operations, and laboratory for the same has been established. The Summer Camp for Civil Engineering and Forestry has been established and was operated for the first time at Gilead, Maine, during this past summer. A new 40-hp. hydraulic turbine was installed in Crosby Laboratory during the past year. In the State Highway Testing Laboratory a machine for testing paint for road markings was invented and installed. Researches are being carried on on cements and concrete and in the departments of Chemistry, Electrical, and Mechanical Engineering and in Pulp and Paper Technology, many of them in coöperation with industrial firms and corporations.

University of Maryland.—Effective October 1, 1936, Professor S. S. Steinberg was appointed Acting Dean of the College of Engineering of the University of Maryland to succeed Dean A. N. Johnson, who became Dean Emeritus.

Professor Steinberg has been Head of the Department of Civil Engineering for the past sixteen years. Dean Johnson has also served for the same period of time.

Following are additions to the teaching staff of the College of Engineering, effective October 1, 1936: Arne Wikstrom, formerly instructor at Cornell University, appointed Assistant Professor of Electrical Engineering. G. C. Ernst, formerly instructor at Iowa State College, appointed Instructor in Civil Engineering. Harry R. Hall, Chief Engineer, Washington Suburban Sanitary District, appointed Lecturer on Municipal Sanitation. F. G. Kear, Consulting Radio Engineer, appointed Lecturer on Electrical Com-

munications. R. S. Dill, National Bureau of Standards, appointed Lecturer on Heating, Ventilation and Refrigeration.

Michigan State College.—Albert H. Gower, of the graduate school of Harvard University, has been appointed Instructor in Chemical Engineering to replace H. T. Walworth who has resigned to accept a position with the State Department of Health, investigating the industrial health conditions. Denton D. McGrady, a graduate of Iowa State College, has been appointed half-time graduate assistant in Chemical Engineering. C. N. Rix and Kenneth J. Trigger, instructors in Mechanical Engineering, have been given a year's leave of absence. Mr. Rix has gone to the General Motors Institute at Flint, and Mr. Trigger to Swarthmore College. Edward Anderson, formerly with the Scientific Engineering Corporation of Tulsa, Oklahoma, has been appointed for one year as instructor in Mechanical Engineering to replace Mr. Trigger.

C. P. Randall, Michigan College of Mines, and L. G. Schneider, Michigan State College, have been appointed graduate assistants in Mechanical Engineering. J. S. Kocal, Michigan College of Mines, and H. L. Thompson, Rose Polytechnic Institute, have been appointed half-time graduate assistants in Civil Engineering.

The Chemical Engineering laboratories formerly located in the Chemistry Building, viz., Pyrometry, Metallography and Fuels, as well as the office of the department have been moved to the Engineering Building.

The enrollment in the Engineering Division of the College has increased about ten per cent over that of last year, the total enrollment now being 616. Chemical Engineering again has the largest enrollment, with 139, Mechanical 118, Electrical 67, Civil 52, and 239 freshman.

Michigan College of Mining and Technology.—With registration figures within two of the 215 record number reached in 1931, all courses show satisfactory enrollment. Mining is the most popular course with 45 new men registered. Chemical engineering is second with 42 new enrollees, while metallurgy is third with 29.

Honorary degrees granted at the time of the inauguration of Grover C. Dillman as president were granted to Mr. Dillman and Nathan S. Osborne, U. S. Bureau of Standards physicist and Tech graduate. Earlier in the year D.Eng. degrees were granted to Earl T. Stannard, president of the Kennecott Copper corporation, and Louis S. Cates, president of the Phelps Dodge company. Mr. Dillman was inaugurated at the time of the 50th Anniversary celebration of the college, August 5, 6, and 7.

New faculty appointments are Robert M. Dickey, geology head; U. J. Noblet, forestry head; Donald Sherman, athletic director; Glen Wimmer, mechanical engineering instructor; John Taras,

chemistry instructor; George Lyle, electrical instructor; R. B. Miller, forestry instructor; and Burney Bennett, English instructor. Of these men all but three are replacements for men who resigned last year or are now on leave.

Headed by Assistant Professor Noblet, the new forestry course shows favorable enrolment and has received much favorable comment. An arboretum has been started on the rear slope of the campus and the 1000 native and non-native trees will serve as a "laboratory" for the students. This project is almost completed.

Another important change at Michigan Tech is the absorption of the old electrical honorary society, Pi Lambda Kappa, into the national organization Eta Kappa Nu. Electrical engineering ranks fourth in popularity with entering Tech students.

At the **University of New Hampshire** last spring we appointed a committee to coördinate the instruction of the College of Technology, and after several meetings the Committee has proposed that it act as an Instructional Plans Committee for the College and is going ahead along this line. Although we had the feeling that our work was quite well organized, the Visiting Committee of the Engineers' Council for Professional Development was able to point out a number of weaknesses in our instructional plan. This constructive criticism really inspired the appointment of this Committee, and we look forward to some excellent results from the studies to be made. The Committee is composed of the younger men with professorial titles of the departments making up the College.

This summer we completed the equipment of the steam laboratory of our Mechanical Engineering Department by the addition of a Uniflow and a Compound engine. The Power Plant of the University, built in 1928, was designed, directed and supervised by members of the faculty of this Department. The plant was built to be used for instruction in this field and is equipped so that tests may be made at any time without previous arrangement with the operating engineer. This plant and our regular teaching laboratory are now equipped to give us unusually complete facilities for instruction in this field.

Richard L. Lewis, graduate in Chemical Engineering from the University of Pittsburgh, is a new member of the staff of our Engineering Experiment Station. Another new member of this staff is Lewis A. Knox, a graduate in Electrical Engineering from the University of New Hampshire of the class of 1935. The other members of this staff are Edwin R. Rath, graduate in Electrical Engineering, University of Pittsburgh, 1917 and E.E. in 1921; Edmund H. Dickerman, graduate in Industrial Engineering from the University of New Hampshire in 1932, and Willard T. Parker, a graduate in Mechanical Engineering from the University of New

Hampshire in 1934. During this last year there was $2500 worth of new equipment added to the facilities of the Station, in addition to about $100 worth that was presented by concerns to whom we have rendered assistance in the solution of some of their specific problems.

A completely equipped Soils Mechanics laboratory has just been added to the facilities of our Civil Engineering Department and will be operated under the direction of Professor R. R. Skelton.

Oregon State Agricultural College.—Charles S. Keevil, formerly Professor of Chemical Engineering and department head at Oregon State College, has recently resigned to accept a similar position at Bucknell University. Prof. George W. Gleeson has been promoted to the position of acting head to fill the vacancy. E. G. Locke, formerly with the Reading Iron and Coal Company of Pottsville, Pa., has been added to the staff with the title of Assistant Professor of Chemical Engineering. Benjamin F. Ruffner, formerly instructor in aeronautical engineering and in charge of wind tunnel research at the Guggenheim School of Aeronautics at New York University has been appointed assistant professor in charge of the aeronautical engineering option in Mechanical Engineering. S. H. Graf, Director of Engineering Research and Professor of Mechanical Engineering at Oregon State College has recently been appointed as consulting engineer on the Willamette Valley project being developed by the U. S. Engineer Department. Professor Graf is also rendering similar services on the Bonneville project. F. A. Everest, formerly with the Don Lee Broadcasting System, Television Division, at Los Angeles, has been added to the staff as instructor in Electrical Engineering.

There has been a considerable increase in enrollment this year, particularly in the School of Engineering. The present total enrollment in the School of Engineering is 756, an increase of 25 per cent over last year. The number of freshmen in the School is 305, an increase of 30 per cent over last year.

I give you the following information as they pertain to **Purdue University**:

New Staff Members.

Applied Mechanics: J. S. Osborn, Assistant, B.S.M.E., Purdue University, 1933; T. J. Herrick, Assistant, B.S.M.E., University of Illinois, 1936; L. W. Rothenberger, Assistant, B.S.Ch.E., Purdue, 1936.

Chemical Engineering: Robert B. Moore, Instructor, B.S.Ch.E., 1935, M.S.Ch.E., University of Minnesota, 1936.

Civil Engineering: M. E. Neligh, Instructor, B.S.C.E., Purdue University, 1933. Experience: Five years with the Indiana State

Highway Commission; Thos. C. Hanson, Instructor, B.S., Purdue University, M.S., University of Michigan. Experience: University of Detroit; Ward B. Miller, Assistant, B.S.C.E., 1936, Purdue University; Fred J. Benson, Instructor, B.S.C.E., Kansas State, M.S., Texas A. and M. College. Experience: Graduate Assistant at the Texas A. and M. College.

Electrical Engineering: Frank O. Nottingham, Jr., Assistant, B.S., University of Virginia, 1924, M.S., M. I. T., 1936. Experience: General Electric Company, Virginia Electric and Power Company, Brooklyn Edison Company, Inc., with allied teaching experience at Pratt Institute. Paul H. Reedy, Assistant, B.S.E.E., Rose Polytechnic Institute, 1935. Experience: Purdue University, Engineering Experiment Station.

Mechanical Engineering: Melvin Price, Assistant Professor, B.S.E.E., 1897 and E.E., 1902, Purdue University, M.S., Columbia University. Experience: Thirty years of teaching and industrial experience. G. A. Hawkins, Assistant Professor, B.S.M.E., 1930, M.S., 1932, Ph.D., 1935, Purdue University. Experience: Instructor in Applied Mechanics and Associate, Purdue University, Engineering Experiment Station; H. J. Stoever, Assistant Professor, B.S.M.E., Purdue University, 1928, M.S., University of Illinois, 1930, Ph.D., University of Illinois, 1934. Experience: Westinghouse Company, Linde Air Products Company, California Institute of Technology; C. W. Messersmith, Assistant Professor, B.S., 1927 and M.S., 1936, Purdue University. Experience: In connection with draft gear tests for the Association of American Railroads; R. C. Binder, Instructor, B.S., M. I. T., 1930, M.S. and Ph.D. from California Institute of Technology in 1936.

Practical Mechanics: J. J. Ermenc, Instructor, B.S., University of Wisconsin, 1934.

Personnel: James T. York, Assistant, B.S., Towne Scientific School, 1936.

Staff Promotions and Changes.

Promotions:

Applied Mechanics: S. D. Chambers from Associate Professor to Professor.

Civil Engineering: W. E. Howland from Assistant Professor to Associate Professor.

Electrical Engineering: L. E. Beck from Instructor to Assistant Professor; J. H. Bowman from Instructor to Assistant Professor.

Mechanical Engineering: H. L. Solberg from Associate Professor to Professor; W. T. Miller from Assistant Professor to Associate Professor.

Practical Mechanics: J. N. Arnold from Instructor to Assistant

Professor; F. W. Duff from Assistant to Instructor; M. H. Bolds from Assistant to Instructor; P. W. Case from Assistant to Instructor; L. V. Moser from Assistant to Instructor; L. V. Schaller from Assistant to Instructor.

Resignations and Leaves of Absence.

Chemical Engineering: J. W. Campbell resigned to accept position at Stanford University.

Civil Engineering: W. E. Howland, Associate Professor, on leave during 1936–37 to pursue studies at Harvard University; C. V. Allen, Assistant, resigned to take position with Chicago Bridge and Iron Works: J. D. Richetta, Assistant, to accept position with the State Division of Health.

Electrical Engineering: B. H. Short, Instructor, resigned to accept position at Clemson College.

Mechanical Engineering: G. M. Bartlett, deceased. D. P. Craig resigned to accept headship of Mechanical Engineering at Colorado State College; J. A. Sauers on leave of absence due to illness; C. R. Egry resigned to accept position at University of Detroit; W. A. Trayler, Assistant, resigned to enter industry; L. E. Endsley, Assistant, resigned to enter industry.

Practical Mechanics: F. H. Smith, Instructor, resigned to accept position with Brown and Sharpe.

Personnel: J. H. Calvert, Assistant, resigned to enter industry.

Rhode Island State College.—We are sorry to have to report that our School of Engineering has suffered the loss through death of two esteemed department heads. Professor Wm. Anderson, of the Department of Electrical Engineering, passed away on December 27, 1935, after a brief illness, and Professor S. H. Webster, head of the Department of Civil Engineering since 1907, failed to recover from an operation he was forced to undergo in June. Both men had given their best to the upbuilding of the College through its critical years of growth. The foundations which they laid will give lasting recognition to their work and the influence of their kindly personalities will long be felt on the Rhode Island campus.

During the present year R. E. Brown, Assistant Professor of Mechanical Engineering, is devoting a well earned leave of absence to study for the Doctorate at M. I. T.

The position as head of the Department of Electrical Engineering has been filled by the appointment of W. B. Hall from Yale University, and the corresponding position in Civil, by F. W. Stubbs Jr. of the University of Illinois. E. M. J. Pease has come to the College as Assistant Professor of Mathematics and Electrical Engineering. J. J. Devine has been made Instructor and will give his time to the Drafting Department. Donald E. Stearns

has been advanced to an Assistant Professorship in Civil Engineering. A. N. Guthrie has come to the College from Columbia University to head the Department of Physics, and T. S. Crawford from industry to take charge of the work in Chemical Engineering. E. L. Carpenter returns to R. I. after several years teaching and research in the South as Assistant Professor of Mechanical Engineering in charge of Power and Construction.

The only important change in curriculum to report results from an effort to broaden the foundations in the work of civil engineering, by including a year's work in thermodynamics and electrical engineering in the program of studies.

The P.W.A. building program of about one and a quarter million dollars is nearing completion. Of engineering interest are the new water system and a modern oil fired heating plant of sufficient capacity to meet all probable growth for many years. Other features of general interest in the development of the College are a new Library and Administration Building, Home Economics Building, Girls' Dormitory, Dairy Group, Cafeteria and remodelled class rooms.

Rose Polytechnic Institute.—After thirty-three years as head of the Department of Chemical Engineering and Chemistry at Rose Polytechnic Institute, Dr. John White retired at the close of the last college year. At the commencement exercises he received the honorary degree of Doctor of Science. His successor is Ralph K. Strong, formerly head of the Department of Chemical Engineering at Oregon State College and Professor of Industrial Chemistry and head of the department at Reed College. Dr. Strong is a graduate in both arts and engineering of Acadia University and has the degrees of M.A. from Harvard and Ph.D. magna cum laude from the University of Chicago. In addition to his teaching experience, Dr. Strong has had several years' industrial experience as Superintendent of the Montreal Chemical Works.

Paul G. Hoel, Assistant Professor of Mathematics, is spending the year at the University of Oslo, on a fellowship from the American-Scandinavian society. William D. Crozier, formerly of Iowa State College, has been appointed to the Department of Mathematics at Rose.

Herman A. Moench, who has been on a year's leave of absence at the University of Michigan as a candidate for the doctor's degree in electrical engineering, returned to the Rose faculty this fall.

Harve N. Chinn, Assistant Professor of Civil Engineering for the past seven years, was fatally injured by an automobile on June 18th at Plainfield, Indiana, while engaged in a highway

crossing survey for the Highway Department of the State of Indiana.

Swarthmore College.—Professor Charles G. Thatcher is absent on leave for the year 1936–37, and is doing advanced work at Johns Hopkins University. His place is being filled by Kenneth J. Trigger of Michigan State College.

On October 24, 1936, Ferris Hall, housing the administration offices of the Engineering College and the Departments of Electrical Engineering and Hydraulic Engineering, at the **University of Tennessee** was dedicated with appropriate ceremonies.

Dean Charles E. Ferris for whom the building was named, has been a member of the faculty of the University of Tennessee for forty-five years and Dean of Engineering for thirty-three years. Dean Ferris has been a prominent figure in engineering education, and is still active as Dean of Engineering and as an outstanding teacher of thermodynamics.

Sharing the honors with Dean Ferris at the dedication ceremonies was Charles A. Perkins, Professor of Electrical Engineering, who came to the University of Tennessee forty-five years ago. Dr. Perkins retired in 1929 as Head of the Department of Electrical Engineering and since that time has been active as Director of the Engineering Experiment Station and Professor of Electrical Engineering.

The outstanding feature of the dedication program was the presentation and unveiling of busts of Dean Ferris and Dr. Perkins. The busts were the gift of Engineering Alumni of the University and were the work of Mr. Gilbert Switzer of Philadelphia. Mr. Switzer is a former student of the University and a son of Professor and Mrs. John A. Switzer of the University of Tennessee.

Major Thomas H. Allen, class of 1903, made the dedicatory address, and the busts were presented by Mr. John B. Cox, B.S. in M.E., 1893, on behalf of the engineering Alumni. Mrs. Switzer, mother of the sculptor, unveiled the busts. The busts of Dean Ferris and Dr. Perkins will be given a place of prominence in Ferris Hall. Ferris Hall is the main building of a future building program which is to include new wings housing the Mechanical, Civil, and Chemical Engineering Departments.

Texas Technological College.—In the Division of Engineering, we have had for the fall semester an approximate increase of twenty-five per cent over our enrollment for the fall semester of last year.

We have had but one change in the personnel of our engineering faculty. Mr. Clovis Green has accepted the position of Instructor in the Mechanical Engineering Shops. He replaces Mr.

T. Cecil Worley who resigned late last spring to accept a position with the U. S. Bureau of Standards.

Professor M. E. Heard, who was appointed Acting Head of the Department of Textile Engineering for the school year, 1935–36, has been made Head of this Department, this appointment becoming effective in September, 1936.

This year for the first time the Texas Technological College is offering the degree, B.S. in Geological Engineering, Geophysics Option. This curriculum will give students training in the fundamental principles of geology, physics, and electrical engineering which will equip them for geophysical work with oil companies.

The College of Engineering at **The University of Texas** officially began its 1936–37 long session on the 21st of September. This is the first session under the guidance of Dean W. R. Woolrich, newly appointed Dean of the College of Engineering, who succeeded Dean T. U. Taylor. Dean Taylor at the age of seventy-eight relinquished his duties after forty-eight years of service in that capacity.

Dean Woolrich has been in charge of the Agricultural Industrial Division of the T.V.A. for the past three years, preceding which he was head of the Department of Mechanical Engineering at The University of Tennessee for fourteen years. He holds the degree of B.S. in Electrical Engineering and the degree of Mechanical Engineer from the University of Wisconsin.

Harry H. Power, formerly Chief Production Engineer for the Gypsy Division of the Gulf Oil Corporation, has been added to the staff of the Department of Petroleum Engineering as Professor and Chairman of the Department. Professor Power is a graduate of Washington State College and holds a master's degree in Petroleum Engineering from the University of California.

E. H. Shulz is the new instructor in the Department of Electrical Engineering, he having been appointed to take the place left vacant by the resignation of Mr. B. H. Caldwell, who has entered the employ of the General Electric Company at Schenectady.

W. C. Murray has been appointed an instructor in Petroleum Engineering to take the place of Mr. E. C. Sargent, who resigned to accept a position in the petroleum industry.

University of Toledo.—Cornelius G. Brennecke and Mr. Edward L. Manneg were recently appointed full-time instructors in the College of Engineering of the University of Toledo, the former in electrical engineering and the latter in civil engineering.

Mr. Menneg enters teaching with his present appointment, following six years of professional experience with the New York

Central Railroad Company. Dr. Brennecke's professional experience was in the field of radio engineering, and he was most recently engaged in teaching and research in physics at New York University.

The Tulane University of Louisiana.—Charles Joseph Manney, Columbus, Ohio, has been appointed Instructor in Mechanical Engineering.

Mario G. Zervigon of Knoxville, Tennessee, has been appointed instructor in Electrical Engineering.

The Virginia Polytechnic Institute.—Members of the staff who have returned to duty after leaves of absence are: R. B. H. Begg, Dept. of Civil Engineering, F. J. Sette, Sanitary Engineering, P. H. McGauhey, Civil Engineering, Paul P. Stewart, Architectural Engineering.

The administrative offices of the college have been moved to the new administration building. The former administration building has been turned over to the School of Engineering and is being occupied by the departments of Metallurgy and Sanitary Engineering.

F. F. Groseclose, Instructor in Mechanical Engineering, has resigned to become Associate Professor of Mechanical Engineering at the University of North Carolina. Robert M. Johnston, a graduate of Penn State, has been appointed instructor in Mechanical Engineering. Robert A. Fisher has been added to the staff as Assistant Professor of Chemical Engineering. Dr. Fisher had his training at Ohio State University and comes to V. P. I. from the University of Louisville. Carl D. Croskey, Ohio State 1933, has been appointed Instructor in Ceramic Engineering in the place of Paul S. Dear, who is on leave of absence to pursue graduate work at the Penna. State College.

Registration for 1936–37, as of October 1, totalled 1103, of which 446 were freshmen. This represents an increase of 11 per cent over the previous session.

University of Washington.—Additions to our equipment in engineering educational and laboratory facilities are:

(*a*) The new Wind Tunnel.
(*b*) New quarters and laboratory facilities for the Department of Chemical Engineering in the Chemistry-Pharmacy Building now under construction.
(*c*) The River-Model Laboratory that has been built adjacent to the Hydraulics Laboratory.
(*d*) An addition to the University Power Plant.

(*a*) The construction of the new Wind Tunnel was made possible through the coöperative efforts of a number of agencies, including the State, the Federal Government and the Boeing Airplane Company.

The new Wind Tunnel will have a testing section of 12 feet by 8 feet, in which a wind velocity of 250 miles per hour will be available. Furthermore, it is our hope that with the installation of the new Eastman Balances it will be possible to shorten greatly the time necessary to take the large amount of experimental data required when a wing section or other structural part is undergoing tests. The aerodynamic forces acting on a model under test will be measured accurately and nearly instantaneously, so that, for the first time in the history of aerodynamics, transient force reactions of extremely small duration can be measured. There will be six balances in operation at the same time, and by photopraphing the force readings indicated by a number of instruments mounted upon a special switchboard panel, the test can be performed with unprecedented speed, cutting down the time of a normal airplane test from two days to not more than one-half hour.

(*b*) The River-Model Laboratory is a structure of outdoor channels that has been built adjacent to the Hydraulics Laboratory Building for the purpose of studying problems that arise in connection with anticipated hydraulic developments within the State, particularly such public improvements as water supply, irrigation, power, and flood control. Owing to our mild climate, it was possible to build the plant out-of-doors and thus obtain, at a cost of approximately $20,000, facilities which would normally cost several times as much.

(*c*) The new Chemistry-Pharmacy Building, in which the department of Chemical Engineering will be housed, is in the process of construction. The new quarters will provide ample space, and it is hoped that sufficient equipment may be installed to give us an excellent up-to-date Chemical Engineering Laboratory complete with apparatus.

Industrial Chemistry will be allowed to expand into a study of unit commercial processes. Particular attention will be given to the manufacture of pulp, the utilization of fish and vegetable oils, and to electro-chemical industries. Facilities for undergraduate and graduate research will be greatly improved, thus making it possible to undertake basic studies such as the hydrogeneration of coal, the chemical properties of wood, electro-chemical products, and the unit operations of chemical engineering.

(*d*) The Power Plant of the University has been considered for many years as an adjunct to the Department of Mechanical Engineering laboratories. Students are regularly scheduled for tests upon machinery operated in the Power House for service to Buildings and Grounds. During the past year the Power House has been remodeled, antiquated equipment has been discarded and a new turbo-generator of 1250 hp capacity has been installed, together with condensing equipment. Provision has been made for the installation of a second turbo-generator of 1250 hp capacity, without further alterations.

Worcester Polytechnic Institute.—Daniel F. Calhane, for thirty-three years Professor of Industrial and Applied Chemistry, has retired to enjoy a well earned rest. His place will be taken by Assistant Professor Frank C. Howard, who comes from the University of Illinois, as Professor of Chemical Engineering. Another new face on the faculty will be that of Professor Robert B. Kolb, formerly of the University of Alabama, who replaces Gustaf A. Gaffert, for two years Assistant Professor of Heat-power Engineering. Dr. Gaffert has resigned to work in the industrial field. An exchange professorship in the Department of Civil Engineering has been effected, Professor Carl F. Meyer going for the year to the University of Hawaii, while Russell C. Brinker, Instructor in Civil Engineering comes from Hawaii to Worcester Tech. Another face that will be missed on the Hill is that of Albert S. Richey, Professor of Electrical Engineering and of Business, whose death occurred on June 24th.

Seven instructors have been promoted to the rank of Assistant Professor. They are: Edward C. Brown, of the Department of Mathematics; Harry B. Feldman, of the Department of Chemistry; J. Edward Fitzgerald, and Edwin Higginbottom, of the Department of Modern Languages; Willard E. Lawton, of the Department of Physics; Albert J. Schwieger, of the Department of Economics and Government; and Paul R. Swan, of the Department of English.

Albert J. Schwieger and Robert T. Young, of the Department of Physics, received the degrees of Doctor of Philosophy from Harvard University during the past year. Dr. Young was employed last summer by the Scripps Institute to do research work on the penetration of light in the Pacific Ocean.

Among the members of the faculty who travelled and studied in Europe during the summer were Dr. Arthur W. Ewell, Dr. Leland L. Atwood, and Dr. Richard A. Beth. Professor Theodore H. Morgan and Victor Siegfried, of the Electrical Engineering Department, attended the summer convention of the American Institute of Electrical Engineers at Pasadena, California, during the

summer and presented a paper on a new test for determining stray load losses in induction motors.

Extensive changes in the Alden-Hydraulic Laboratory at Chaffins include the erection of a two-story addition, seventy by twenty-eight feet, to the main laboratory. The penstock has been brought indoors, and an additional water supply has been provided through a new thirty-inch penstock. There are now two sources of supply which greatly increases the elasticity of the system. The new Electronics and Communications Laboratory in the Electrical Department has been completed, providing material additions to the facilities for instruction and investigational work.

SECTIONS AND BRANCHES

The **Allegheny Section** held its annual meeting at Pennsylvania State College, October 23–24, 1936.

Friday Afternoon, October 23

2:30 to 3:15 P.M. Registration—Student Union Desk, Old Main.
3:15 P.M. General Meeting—107 Main Engineering, Prof. C. E. Bullinger presiding.

Welcome—A. O. Morse, Executive Secretary.
Response—Chairman of the Section—H. M. McCully, F. L. Bishop, Secretary of the S. P. E. E.
Business Meeting—H. M. McCully presiding.
Presentation of minutes.
Election of officers.
Other business.
Address—Dean R. L. Sackett presiding.
Theme—"The Evaluation of Engineering Education and Student's of Engineering.

1. The Relationship of Validity and Reliability to Evaluation. R. G. Bernreuter, Chief, Special Education. The meaning of these two terms as they apply to the various measuring procedures that the teacher uses.
2. Evaluation for Admission. What factors does the admission officer consider and how does he value and apply them. Prof. Boomsliter, University of West Virginia.
3. Evaluation for Specific Courses. What values does the teacher give to the various elements of his teaching such as quizzes, examinations, outside reports, recitations, attendance and final exams. Prof. Kintner, Bucknell University.
4. Evaluation by the Use of Comprehensive Examinations. How are these used to decide if a student should enter the Junior year or as qualifications for graduation. President R. E. Doherty, Carnegie Institute of Technology.
5. Evaluation and the Student's Personal Problems. What factors enter into the work of the student advisor and how may they be valued and related. Prof. O. C. Held, University of Pittsburgh.

Friday Afternoon, October 23

Ladies Program

Tea at the home of Mrs. L. A. Doggett, 357 E. Prospect Ave.

4:00 to 6:00 P.M.

Friday Evening, October 23

7:00 P.M. Informal Dinner. Sandwich Shop.
President R. E. Doherty, Presiding.
Address by H. P. Hammond, President of the S. P. E. E.
9:00 P.M. Informal Get-Together Lounge of Old Main.

Ladies Entertainment—Bridge
Gallery Second Floor Old Main

Saturday Morning, October 24

Group Conferences in Various Departments

General Time Schedule for Conferences and Inspection Trips

9:00 to 10:50 A.M. Conference as per list which follows:
11:00 A.M. to noon. Inspection trip through laboratories of departments conducting conferences.

1. Chemical Engineering, 200 Textile Chemistry Building.
   Prof. Donald Cryder, presiding. The Pennsylvania State College.
   a. Problems of Petroleum Refining. Prof. R. M. Fenske.
   b. The Chemical Engineering Laboratory at Penn State. Prof. Cryder.
2. Civil Engineering, 108 Main Engineering.
   Prof. D. M. Griffith, Bucknell University, presiding.
   a. Subject to be announced. Prof. H. P. Hammond, Brooklyn Polytechnic Inst.
   b. The Hydraulics Camp of The University of Pittsburgh. Prof. L. C. McCandliss, University of Pittsburgh.
   c. The Presentation of Elementary Hydraulics. Prof. R. O. O'Donnell, The Pennsylvania State College.
   d. Sewage Disposal in Small Towns. Prof. H. W. Speiden, University of West Virginia.
   e. Some Notes on the Teaching of Undergraduate Structural Courses at Carnegie Institute of Technology.
      A. Steel and Timber. Prof. F. J. Evans.
      B. Concrete and Reinforced Concrete. Prof. F. M. McCullough.

3. Drawing, 204 Engineering C.
   Prof. L. D. Hayes, West Virginia University, presiding.
   a. Aids to Visualization. Prof. V. B. Hall, Bucknell University.
   b. The Use of a Graduated Series of Machine Parts in Teaching Machine Drawing. Prof. L. D. Hayes, West Virginia University.
   c. How Engineering Drawing is Taught at the University of Pittsburgh. Prof. W. Irwin Short, University of Pittsburgh.
   d. Present Day Reactions of the Industries to the College—Trained Draftsman. Prof. H. M. McCully, Carnegie Institute of Technology.
   e. The Conference Method for Teacher Preparation. Prof. A. L. Tobias, The Pennsylvania State College.
4. Electrical Engineering, 202 Engineering D.
   E. B. Roberts, Westinghouse Electric and Manufacturing Co. presiding.
   a. The Young Engineer Under Changing Conditions. R. E. Gellund, The Westinghouse Electric Manufacturing Co.
   Discussion:
   H. E. Dyche, University of Pittsburgh.
   Wm. R. Work, Carnegie Institute of Technology.
   A. H. Forman, University of West Virginia.
   C. L. Kinsloe, The Pennsylvania State College.
   b. An Experiment in Alternating Current Circuits. Prof. George A. Irland, Bucknell University.
5. Industrial Management, 209 Engineering C.
   Prof. H. H. Rothrock, University of Pittsburgh, presiding.
   a. Projects used in Teaching Motion Study. Prof. J. O. P. Hummel, The Pennsylvania State College.
   b. Motion Study in Education and Industry. Prof. O. E. Honning, Carnegie Institute of Technology.
   c. The Teaching of Management. Prof. C. E. Bullinger, The Pennsylvania State College.
6. Mechanical Engineering, 210 Main Engineering.
   Prof. Thomas G. Estep, Carnegie Institute of Technology, presiding.
   a. Changing Aspects of Instruction in Thermodynamics. Prof. L. L. Amiden, West Virginia University.
   b. Foundry Practice for Engineering Students. Prof. William H. Dosey, Cornegie Institute of Technology.
   c. Research by the College for Industry. Prof. H. A. Everett, The Pennsylvania State College.

The **Bucknell** section meets the first and third Wednesday of each month at 4:30 P.M., in room 205, Chemical Laboratories. The officers for 1936–37 are: Chairman, R. C. Kintner; Secretary, W. D. Garman.

W. D. GARMAN,
Secretary

The officers of our **Colorado-Wyoming Section** for S. P. E. E. are:

President, Dean Ralph D. Goodrich, University of Wyoming.
Secretary-Treasurer, Professor Stanley P. Hunt, University of Wyoming.

The first meeting of this year will be held at the University of Wyoming, Laramie, Wyo., on November 14.

University of Detroit Branch.—The 1936–37 officers of this branch will not be elected until the December meeting of this year. In the meantime the 1935–36 officers preside.

No specific day of the month is set aside for our meetings. The meetings are called by the chairman and are usually held about the middle of each school month.

CLAIR C. JOHNSTON,
Secretary

The **Illinois-Indiana** Section meets in the spring, and the date will be about Saturday, April 10. Our executive committee will meet sometime this fall, before the Christmas holidays, and at that time definitely set the date and begin to plan the program.

The officers of the Section are as follows: President, R. P. Hoelscher, University of Illinois; Vice-President, H. S. Philbrick, Northwestern University; Secretary, S. M. Spears, Armour Institute. Executive Committee: O. L. Stock, Rose Polytechnic Institute; R. N. Shreve, Purdue University; M. A. Faucett, University of Illinois; J. C. Peebles, Armour Institute.

R. P. HOELSCHER,
President

The fall meeting of the **Kentucky Section** of the Society was held at the University of Kentucky, October 24. Following is the program.

10:30 A.M.—Dean B. M. Brigman will be in charge of Round Table Discussion of Accrediting of Engineering Schools.
11:45 A.M.—Election of new officers.
12:00 Noon—Inspection of new buildings on University of Kentucky Campus.

12:30 P.M.—Luncheon at University Commons.
2:00 P.M.—U. of K. versus U. of Florida football game for those who want to see it.

S. T. FIFE, *President,*
Ky. Branch, S. P. E. E.
PROF. D. V. TERRELL, *Vice-President,*
University of Kentucky.
PROF. R. C. ERNST, *Secretary,*
University of Louisville.

Fall Meeting, Middle Atlantic Section.—All engineers interested in education are invited to the meeting at Columbia University on December 5th which will focus attention on the humanities content of engineering curricula. Horace Taylor, Professor of Economics, and Harry Carman, Professor of History at Columbia University, will present a paper on the Columbia course, "An Introduction to the Contemporary Civilization of the West." This study of the economic, political, scientific, and social factors which have developed our western civilization, and the place of such studies in engineering curricula, will be discussed by Harvey N. Davis, Stevens Institute; Herman Diederichs, Cornell University; H. S. Rogers, Polytechnic Institute of Brooklyn; and W. O. Hotchkiss, Rensselaer Polytechnic Institute.

The evening meeting will be addressed by Dr. Nicholas Murray Butler, President of Columbia University, Professor H. P. Hammond, President of the S. P. E. E. and Professor J. K. Finch.

The points of interest that will be covered on the guided morning tours will include the following: Grant's Tomb, Riverside Church, Cathedral of St. John the Divine, and on the Columbia campus—the new University Library, Geology Museum, Metallurgy Museum, School of Architecture, the Student Center, the University Chapel, the Pupin Physics Laboratories including the cyclotron under construction, Neutron studies, equatorial telescope, etc.

The Committee in charge of arrangements for the meeting includes: J. W. Barker, Chairman; F. L. Eidmann, Vice Chairman; Mrs. J. W. Barker, F. H. Dutcher, G. T. Harness, F. H. Lee, E. R. Jette, A. D. Hinckley, L. T. Work, J. A. Oakey, B. G. Johnston, P. B. Bucky, and R. M. delGuidice.

The afternoon meeting will be followed by special demonstrations in all of the engineering laboratories. A feature of this will be the demonstration by Professor E. A. Armstrong of his new system for radio broadcasting.

The officers are: Chairman, Frank L. Eidmann, Columbia University; Vice-Chairman, A. C. Stevens, General Electric Co.,

Schenectady; Secretary-Treasurer, C. D. Fawcett, University of Pennsylvania.

A. D. HINCKLEY.

The fall meeting of the **New England Section** of the Society was held at the University of Vermont, Burlington, Vermont, on Saturday, October 10. The total registration was 254 members and guests.

Registration was held from 9:00 until 10:00 A.M. in the lobby of the Fleming Museum.

From 10:00 A.M. until 12:00 M. five professional conferences were held. These were as follows:

A. Educational Aims and Techniques of Engineering Education.

Chairman: Dean Samuel W. Dudley, Yale University, Attendance: 33.

Symposium: European Views of Engineering Education in America.

1. British—Dr. Norman H. Goodier, Ontario Research Foundation, Toronto.
2. Continental—Professor Dimitri P. Krynine, Yale University.

Dr. Goodier is a graduate of Cambridge, and received his doctorate from the University of Michigan. Professor Krynine was educated in Russia and in Paris.

B. Mechanics.

Chairman: Professor Gleason H. MacCullough, Worcester Polytechnic Institute, Attendance: 17.

Photo-Elasticity—"Picture-book" and Research Tool, Mr. Robert W. Vose, M. I. T.

C. Mathematics.

Chairman: Professor James A. Bullard, University of Vermont, Attendance: 17.

A Problem in Educational Engineering, Dr. John L. Barnes, Tufts College.

D. Electrical Engineering.

Chairman: Professor Hubert M. Turner, Yale University, Attendance: 15.

1. A New Projection Oscillograph for Group Instruction, Professor Hobart H. Newell, W. P. I.
2. Is Invention Stimulated by Electrical Engineering Training?, Professor Albert G. Conrad, Yale University.

E. Coöperation of New England Engineering Colleges with Industry.

Chairman: Ray M. Hudson, New England Council, Attendance: 38.

The following industrialists led the discussion:

1. Mr. Claude L. Peake, Manager of Industrial Relations, E. I. DuPont de Nemours Co.
2. Mr. Ralph E. Flanders, President, Jones and Lamson Machine Co.

From 12:30 to 2:30 P.M. the members present were guests of the University at a luncheon in Robinson Hall. At this time Dr. Guy W. Bailey, President of the University, gave a very cordial welcome on behalf of the University and the State of Vermont.

From 2:30 to 3:30 P.M. an inspection of the campus was made under the direction of Professor R. O. Buchanan.

The general session was called to order by Chairman Dean Carl S. Ell of Northeastern University at 3:30 P.M. The minutes of the previous fall meeting at Worcester Polytechnic Institute were read and approved. This was followed by the reading of the constitution.

Chairman Ell appointed the following committees:

Nominations Committee

Professor Chester L. Dawes, Harvard University.
Dean Paul Cloke, University of Maine.
Professor F. N. Weaver, Tufts College.

Committee on Resolutions

Dean G. W. Case, University of New Hampshire.
Dean Royal L. Wales, Rhode Island State College.
Professor Jerome W. Howe, Worcester Polytechnic Institute.

A paper on "Learning, Morals and Manners" by Dean Dexter S. Kimball of Cornell University was read by Professor William C. White of Northeastern University since Dean Kimball was unable to be present. After the reading of the paper, Dean Ell turned the meeting over to Professor Edward L. Moreland, Head of the Department of Electrical Engineering, Massachusetts Institute of Technology, who called on Dean Harry P. Burden, Tufts College, and Professor William H. Kenerson of Brown University for discussion. A short general discussion followed with adjournment shortly after 5:00 P.M.

At 5:15 P.M. an organ recital was given in the Ira Allen Chapel with Miss Miriam N. Marston, Organist.

During the morning the visiting ladies were taken for a tour of the city, under the guidance of a committee of which Mrs. George

F. Eckhard was chairman. At 12:30 they were entertained at luncheon at Twist O'Hill Lodge as guests of the University and during the afternoon they inspected the Fleming Museum and were entertained at tea.

The annual dinner was held at 6:30 P.M. in the New Southwick Hall. Following the dinner, orchestral selections were rendered by University students under the direction of Professor Bennett of the Department of Music.

The evening session was opened by Chairman Ell. Following brief remarks by President Bailey; United States Senator, Warren R. Austin; and the Secretary, Chairman Ell introduced the speaker of the evening, Dr. Lloyd C. Douglas, noted author and lecturer. Dr. Douglas told interesting incidents relating to the writing of his stories and to their subsequent film versions.

The Committee on Resolutions presented the following report:

"The New England Section of the Society for the Promotion of Engineering Education expresses its warm appreciation and thanks to the officers and faculty of the University of Vermont and to their wives for their cordial reception of members and their families attending its sixteenth annual meeting; to the University for the delightful luncheon and use of rooms in which to hold meetings and to local committees whose careful planning has provided for our comfort and opportunity to visit and become acquainted with the many points of interests on the University campus and in its vicinity. The Section particularly expresses its indebtedness to President Guy W. Bailey of the University for his cordial greeting and his active interest which have had much to do in making this meeting a success.

"The Section expresses its appreciation to guests who addressed sessions, especially the speaker of the evening Dr. Lloyd C. Douglas.

"The Section acknowledges with pleasure the presence of United States Senator, Warren R. Austin, as indicating his interest in Engineering Education."

(Signed) JEROME W. HOWE,
ROYAL L. WALES,
GEORGE W. CASE.

The Committee on Nominations presented their report. Dean Carl S. Ell of Northeastern University was elected Chairman and Professor Carlton E. Tucker of M. I. T. was elected Secretary for the ensuing year.

C. E. TUCKER,
Secretary.

Newark College of Engineering Branch.—Officers for 1936–1937: *Chairman,* Prof. Frank N. Entwisle; *Treasurer,* Prof. H. N. Cummings; *Secretary,* Prof. Paul E. Schweizer.

The annual meeting of the **Pacific Southwest** Section of the S. P. E. E. will be held at the University of Arizona in Tucson on December 28, 29, and 30, 1936. The officers of the Section for this year are: Chairman, John C. Park, University of Arizona, Tucson, Arizona; Vice-Chairman, John W. Hazen, Los Angeles Junior College, Los Angeles, California; Secretary-Treasurer, Franklin O. Rose, University of Southern California, Los Angeles, California.

JOHN C. PARK,
Chairman

Pennsylvania State College Branch.—The annual spring meeting of the Branch was held at 7:30 o'clock, Tuesday evening, May 19, 1936, in Room 107, Main Engineering, with Professor A. E. Neyhart presiding. Fifteen members and guests were present.

The minutes of the meeting held on October 22, 1935 were read by the Secretary and approved as read.

The first business was the election of officers for the coming year. The candidates, read by the chairman of the nominating committee, Professor J. O. P. Hummel, were as follows:

For President—Professor L. W. Whitehead
For Vice President—Professor L. A. Doggett
For Sec. Treas.—Professor Albert P. Powell

They were declared elected.

The Secretary announced that the next meeting of the Allegheny Section of the S. P. E. E. would be held at Penn State during the fall of 1936. The committee appointed by the chair to arrange for the Section meeting was as follows: Honorary Chairman, Dean R. L. Sackett; Chairman, Professor C. E. Bullinger; Members, the officers of the Branch.

An announcement of the annual meeting of the Society to be held at Madison, Wisconsin was read. Professor F. C. Stewart gave an interesting description of the Campus at Madison, and Dean R. L. Sackett commented on the program, which was to be "The Making of Men rather than Technicians."

The main speaker of the evening, Dr. Robert G. Bernreuter, of the Department of Psychology of the College, addressed the Branch on the subject "What Can We Expect from a Testing Program?" He stated that tests are teachers' tools and that the aspects of tests which are important are (1) the value of the tests and (2) the extent of this value. In physical measurements tests

can be quite accurate, since there are fixed units of measurement. However, in the measurement of scholastic achievements, etc. there are no fixed units of measurement hence tests may or may not be accurate. There is no absolute zero to such a test; *i.e.*, there is no absolute lack of knowledge; the student knows something. Likewise there is no absolute 100 per cent. And from 0–100 per cent there are no equal units of measurement. Professor Bernreuter further said that it is doubtful if you can add or subtract scores on ability, aptitude, interest, etc. Therefore, we can not do a good job of testing. Yet we must make reports; therefore, we must measure. He then went on to tell us how we could determine if we had a good test or not. To have a good test we must (1) measure its reliability and (2) measure its validity. Reliability of a test means the extent of the test giving a consistent score. There may be an error even in a physical measurement but they are usually so small as to be neglible. He said that the measurement of an increase of knowledge is not particularly reliable. It was like measuring distance with a rubber foot ruler. The average test is unreliable, has an average correlation of 0.65 and best tests run between 0.90–0.95. Another way of putting it: in the average test the reduction of error is not over 25 per cent and in the best tests, not over 50–75 per cent. We can reduce error, *i.e.*, increase reliability, by lengthening tests, increasing the number of samples. If a test is reliable, it may not be good; *i.e.*, valid. In physics a reliable instrument is good. The speaker defined validity as the ability of a test to really measure. "The class mark," he said, "indicates knowledge in a course." A reliable score may not be a valid score. The score may be affected by the emotions. Another aspect of validity is the college record. It is reliable. It is the average score of different instructors for four years, but it may not be a valid indication of the student on a job. "In the measure of ability," he said, "a good reliability shows mechanical ability." General intelligence tests may not be valid. Reliability is easy to determine but validity of a test is not easy to determine. Most of the tests that are available may be reliable but not valid. Tests are not perfect. The error is not better than 50 per cent over chance judgment. Dr. Bernreuter closed by asking: "Is It All Worth While?" "Can We Measure or Even Estimate Future Success?"

Professor Hanrahan opened the discussion by asking about critical scores and grades and brought up the subject of *late reports*. Professor Thayer asked about personal characteristics and knowledge tests. Dr. Bernreuter answered by saying that you select the test which is solved by the exercise of those abilities

which you wish to test. He also stated again that you increase the reliability and validity of your test by lengthening your tests, getting more representative samples. He said that campus grades do not mean anything except on the average. Professor Powell asked about optional questions on a quiz. This was answered by the statement that it was better to have shorter questions and more of them rather than optional questions.

Professor Cassel asked about grading systems. This was answered by the statement that there were two:

(1) Absolute (facts as standards)
(2) Relative

Professor Bullinger told of the grading system in the Industrial Engineering Department in which standard term scores are set up, on the various quizzes, exams, home work, etc.—and the student is made acquainted with this score.

ALBERT P. POWELL,
Secretary

The officers for the **Texas Section** of S. P. E. E. for the year 1936–37:

President, J. A. Correll, University of Texas.
Secretary, Professor Sophus Thompson, Southern Methodist University, Dallas, Texas.

While no definite time has been set for the meeting this year, it has been our custom to hold this meeting about the 21st of April. The meeting will be held in Dallas with the Southern Methodist University as host.

J. A. CORRELL,
President.

The **Tufts Branch** holds meetings once or twice a year, at which questions directly concerning the Tufts College Engineering School are discussed. Our Society activities as a whole are carried on in connection with the New England Section, and this Section has accepted our invitation to hold its fall meeting in 1937 at Tufts.

The Chairman of the Tufts Branch for the coming year is Professor Arthur W. Leighton. As we are organized very informally for local purposes we have no other officers.

FREDERIC N. WEAVER

DIVISION OF MECHANICS

Executive Committee, 1936–37

Name	*Address*	*Term expires* *
Prof. Z. R. Bliss (Secretary)	Brown University Providence, R. I.	1937
Prof. W. R. Cornell	Cornell University Ithaca, N. Y.	1937
Dr. H. L. Mason	Taylor Instrument Co. Rochester, N. Y.	1938
Prof. F. T. Mavis	University of Iowa Iowa City, Ia.	1938
Prof. H. J. Gilkey (Chairman)	Iowa State College Ames, Ia.	1939
Prof. W. J. Cox	Yale University New Haven, Conn.	1939
Prof. Thos. J. Dolan	University of Illinois Urbana, Ill.	1940
Prof. S. B. Folk	Ohio State University Columbus, Ohio	1940

* Term expires after the annual meeting in June.

The T-SQUARE PAGE

DEVOTED TO THE INTERESTS OF THE DIVISION OF ENGINEERING DRAWING

FRANK A. HEACOCK, EDITOR

Reading Drawings.—Engineering drawing trains the mind as well as the hand and the eye. Training freshmen to think in three dimensions is best accomplished by practice in reading drawings. So much emphasis has been placed on making drawings that students are apt to write the drawing language better than they can read it. The educational value of plan reading is not always appreciated.

Every engineering drawing is made to be read, and the easier it is to read the better the drawing. To anyone familiar with orthographic projection it must tell its story clearly, accurately, and completely. This desired result is assured when the draftsman puts himself in the place of each one who is to read the drawing and thus thoroughly understands its readability.

Reading an engineering drawing is a stimulating exercise in constructive thinking. It combines discovery with building. It involves observation, progressive visualization, and a satisfying mental grasp of each detail in its true relation to other details and to the main problem. The beginner has always identified objects by their familiar outline as seen from one side only. It is a revelation to him to build up a form conception from orthographic views. He cannot read an engineering drawing by looking at one view, but must imagine himself moving around the actual object and looking at it from the direction each view is taken. This nimble mental shift from one view-point to another makes the mind supple and stimulates the imagination. The new facts discovered at each view-point build up the mental picture until it becomes a complete realization. This is an excellent way to start developing an alert, engineer-type of mind.

The practical value of plan reading is unquestioned. The ability to visualize and think in three dimensions, which is the direct result of reading drawings, is an essential part of every engineer's equipment.

Skill in reading drawings is not an incidental by-product of drafting. It requires special study and directed effort. Carefully selected exercises of progressive difficulty are needed to develop facility in plan reading. This important part of the work is too often neglected. Considering its educational value as well as its practical utility, let us give this training in reading drawings the attention it justly deserves.

ENGLISH NOTES

DEVOTED TO THE INTERESTS
OF TEACHERS OF ENGLISH
IN ENGINEERING SCHOOLS

J. L. VAUGHAN, EDITOR

THE RELATION OF ENGLISH TO ENGINEERING EDUCATION

A common difficulty encountered by teachers of English to engineering students is the somewhat prevalent attitude on the part of students that the English is really not very important and is in the nature of an obstacle which must be cleared away to open the path toward the real objectives of the engineering course. There is also a tendency to view lightly the admonitions of the professors, the latter being looked upon as hired to give such advice.

It is of course greatly in the interest of increasing prestige and effectiveness of the engineering profession that this attitude should be overcome. Two obvious approaches to the problem are: first, handling of the English instruction so effectively as to achieve respect in its own right; and second, a selection of students so as to exclude a portion of those through whom this unfortunate attitude is supported.

We have also found a third approach decidedly effective; namely the bringing to the students of striking first-hand evidence of the importance which practicing engineers attach to the use of English. This evidence seems to make a far greater impression on the students than any statements or arguments of the professors. One way in which this evidence was secured was the by-product of a series of conferences held with our alumni in New York meeting at different times in separate groups, as for example, architects, chemical engineers, electrical engineers, and so forth. One feature of the program in each discussion was the selection by small subgroups of these alumni as they sat at their tables of eight for dinner of what in their opinion was the most important educational problem in our engineering schools. These problems, originating from each table during the dinner, formed the basis of a general after-dinner discussion. Of the many problems thus submitted in the series of conferences, the importance of English easily took first place in the number of instances in which it was emphasized. We found that this fact and similar first-hand testimony by prominent engineers has made a rather profound impression on our student body.

KARL T. COMPTON

CIVIL ENGINEERING DIVISION

L. E. GRINTER, *Chairman* — K. C. REYNOLDS, *Secretary*
H. C. BIRD — H. E. BABBITT
F. T. MAVIS — HALE SUTHERLAND

REPORT OF THE MEETING OF THE COMMITTEE ON FOUNDATIONS AND SOIL MECHANICS

BY EDWARD E. BAUER

Assistant Chairman, University of Illinois

The committee on Foundations and Soil Mechanics of the Civil Engineering Division held a meeting at Cambridge, Massachusetts, on Saturday, June 27, the day following the close of the International Conference on Soil Mechanics and Foundation Engineering, which was sponsored by Harvard University as part of its Tercentenary celebration. Members of the Conference were invited and approximately twenty five attended, many of whom participated in the discussions. The Committee on Standardization of Symbols and Conventions of the Conference met jointly with our Committee.

The chairman of our Committee, Professor A. Casagrande, Graduate School of Engineering, Harvard University, explained that the efforts of the Committee during the first year were devoted entirely to the International Conference. Professor Casagrande discussed the subject of instruction in soil mechanics expressing the feeling that it is desirable to teach to undergraduates an elementary course in the physical properties of soils and methods of testing. Even though no textbook is available and the entire subject is in the development stage, "soil mechanics lends itself splendidly to the correct training of the minds of the engineer-to-be. It lifts them to a level from which they can see the subjects of mechanics, theory of elasticity, and properties of materials in their true and very interesting relationships."

Dr. Karl von Terzaghi, President of the Conference, emphasized the fact that developments are being made constantly and that the student and teacher must be ever conscious of the possibility of newer ideas superseding old ones. Dr. Terzaghi took one of his papers as an example and pointed out certain changes that have taken place. Concerning undergraduate instruction, he said that the subject of soil mechanics "requires a mature mind and practical experience on the part of the teacher and it excludes the subject from undergraduate courses."

Professors Herbert Ensz, Armour Institute, and D. P. Krynine, Yale, favored essentially only graduate instruction, while Professors W. P. Kimball, Dartmouth; R. G. Hennes, University of Washington; D. M. Burmeister, Columbia; and E. E. Bauer, University of Illinois reported that undergraduate instruction in elementary soil mechanics was being given at their institutions.

Several suggestions were made that the Committee sponsor, during the summer of 1937 or 1938, a short course designed especially for teachers, and also that since they are especially equipped and prepared, Harvard or Massachusetts Institute of Technology, or both, should consider giving instruction in this field during their summer sessions.

Standardization of symbols, conventions, definitions of certain terms, and methods of testing was mentioned by several speakers as being desirable, but only to the extent that it will not interfere with progress. Before proposing any set of symbols and conventions, a survey of existing usage was suggested. Anyone interested in this subject should notify Professor Casagrande for the purpose of creating a mailing list to whom progress reports will be sent and from whom criticisms and suggestions will be invited.

ENGINEERS' COUNCIL FOR PROFESSIONAL DEVELOPMENT

Charles F. Scott, professor emeritus of electrical engineering at Yale University, was reëlected chairman of the Engineers' Council for Professional Development at the fourth Annual Meeting of the Council held in New York on October 6. At the morning session, in addition to the election of officers and chairman of committees, reports of the Council's committees were presented. Interest centered around the report of the Committee on Engineering Schools, and at afternoon and evening sessions formal action on the accrediting of engineering curricula of educational institutions in New England and Middle Atlantic states was taken.

H. H. Henline, national secretary, American Institute of Electrical Engineers, was elected secretary of the Council. By action of the Council the By-Laws were amended to provide for the offices of vice-chairman and assistant secretary, and R. I. Rees, assistant vice-president, American Telephone & Telegraph Company, was elected vice-chairman, and C. E. Davies, secretary, The American Society of Mechanical Engineers, was elected assistant secretary. Chairmen of the Council's committees were elected as follows: Student Selection and Guidance, Robert L. Sackett, dean of engineering, Pennsylvania State College; Engineering Schools, Karl T. Compton, president, Massachusetts Institute of Technology; Professional Training, R. I. Rees; Professional Recognition, Conrad N. Lauer, president, Philadelphia Gas Works; Ways and Means, R. I. Rees; and Information, H. C. Parmelee, editorial director *Engineering and Mining Journal.*

Executive Committee members elected were: J. P. H. Perry (A. S. C. E.), F. M. Becket (A. I. M. E.), C. F. Hirshfield (A. S. M. E.), L. W. W. Morrow (A. I. E. E.), H. C. Parmelee (A. I. Ch. E.), R. I. Rees (S. P. E. E.), D. B. Steinman (N. C. S. B. E. E.).

In addition to the report of the Committee on Engineering Schools, reports of the Committees on Student Selection and Guidance and on Professional Training were approved. The report of the Committee on Professional Recognition was received and held over for discussion at a meeting to be called at some later date.

The report of the Committee on Student Selection and Guidance, of which R. L. Sackett, dean of engineering, Pennsylvania State College, is chairman, was devoted to the committee's studies of co-

operative tests in English and Mathematics with which it has been experimenting in an effort to find a reliable means of predicting a young student's ability to complete a course in engineering training. Results of the Committee's attempts to encourage local groups throughout the country in intelligent selection and guidance of students were reported.

In the report of the Committee on Professional Training, R. I. Rees told of the year's work with junior engineers recently graduated from college. Successful inauguration of organized classes of study for junior engineers of the Providence Engineering Society was announced. It was also reported that the committee had completed its Selected Bibliography of Engineering Subjects for young engineers who wish to continue study in allied fields of engineering.

REPORT OF CONFERENCE ON MINING AND METALLURGICAL ENGINEERING

By G. E. DOAN and ALLISON BUTTS

Lehigh University

Those who made the trip to Madison last June to the forty-fourth Annual Meeting of S. P. E. E. came away delighted. The large and varied program, the record attendance, the splendid facilities of the University of Wisconsin, and the efficiency and hospitality of the hosts all combined to leave a lasting impression of pleasure and profit.

The Mining and Metallurgical Engineering Division held four sessions, attended by about forty members and guests. The first, held on Tuesday afternoon, was presided over by Professor Edward G. Makin of Notre Dame. A unique feature was the distribution of a 250-page bound volume of mimeographed examination papers, covering the various subjects taught in mining and metallurgical departments. Twelve colleges contributed to the volume, an opportunity thus being afforded for comparison of the approach and content of the courses at different institutions as indicated by the examinations given last year. The collection of the material was due to Professor T. T. Read of Columbia, and the preparation of the volume to the department at Wisconsin. Lack of opportunity to digest the contents prevented discussion, which might profitably be held at some future date.

The first speaker at this session was Professor C. Upthegrove, University of Michigan, who introduced the symposium on Laboratory Courses in Metallurgy. His paper was followed by papers by Allison Butts, Lehigh University, and A. T. Sweet, Michigan College of Mines and Technology, and a talk by J. O. Elton, whose principal paper is noted below. An extended discussion ended the session.

The evening session was a joint one with several other divisions, on the subject Teaching of Engineering Economy. Paul T. Norton, Jr., of Virginia Polytechnic Institute, was Chairman.

The Wednesday afternoon session heard two addresses by industrial leaders, in which they gave opinions upon the training of metallurgists for Industry. G. E. Doan, Lehigh, was Chairman. Dr. Walter Mathesius, Superintendent of the Carnegie-Illinois Steel Plant and son of Professor Mathesius of the Charlottenburg

Hochschule at Berlin, gave a scholarly and convincing exposition of Industry's demand for a broader foundation of general education than engineers now receive. He said less time should be spent on specialized technology, not more than forty per cent in all, and more time, at least sixty per cent, should be devoted to general education if the graduates are to be of the greatest usefulness. Lack of this broad background produces students who can not express themselves, engineers who lack the vision of the corporation as a whole, graduates who are ignorant and unaware of the political, social, and economic progress of the world about them.

The engineering courses should create a broad understanding of engineering. The metallurgical courses should serve as appetizers only, to awaken the student's interest in what is to come after graduation. Specially invited discussion was contributed by M. M. Boring, Personnel Officer of the General Electric Company, Dean S. C. Lind, Professor McCaffery, and Dean Bradley Stoughton. Dean T. J. Hoover contributed a written discussion which was read at the meeting.

Mr. James O. Elton, General Manager of the International Smelting Company, represented the non-ferrous field. His view was that post-graduate study often ruined a man's viewpoint for an industrial career, making him unable or unwilling to rub shoulders with other men. In his opinion, character was of greater importance than training in making a man useful to Industry.

After the meeting, a subscription "steak fry," prepared entirely in the laboratory and served in laboratory glassware, was charmingly presided over by Mr. and Mrs. McCaffery and the staff of the Wisconsin Department.

The final session was on Thursday morning. It was devoted to Safety Education, with a paper by E. A. Holbrook of the University of Pittsburgh. T. T. Read was chairman.

BOOK REVIEW

A Text Book of Trigonometry for Colleges and Engineering Schools. By Wm. H. H. Cowles and James E. Thomson. N. Y., D. Van Nostrand, Inc., 1936; x, 373 pp. $2.50.

This book "is the result of a threefold experience of its authors over a period of many years: as teachers of trigonometry to students with varying degrees of preparation; as teachers of topics of pure and applied mathematics that follow trigonometry; and as entrance examiners evaluating the qualifications of secondary school graduates from all parts of the country."

The book is more complete than the usual text in trigonometry, including as it does chapters on complex numbers (De Moivre's theorem), analytical trigonometry, the slide rule, and some well selected applications to plane surveying, geodesy and astronomy.

Radian measure of angles is introduced at the outset and used throughout. The internal structure of the circle is treated in the first chapter, with relations between central and inscribed angles, arcs, sectors, segments, chords and triangles drawn in the circle clearly set forth, the explanation being reinforced by well chosen problems. The good foundation work of the first chapter is continued in the second, where the *general* definitions of the trigonometric functions are introduced and used exclusively. This has frequently been a point of controversy in the teaching of trigonometry. Personally, I prefer the authors' point of view because it tends to banish confusion in the student's mind and also the necessity for unlearning the provisional and inadequate definitions to make way for the final and adequate ones.

A first lesson on the use of the slide rule accompanies instruction in the use of tables in Chapter III on functions of an acute angle. This information is amplified in the next chapter on right triangles. Chapter XVI, which is supplementary, is virtually a manual of the slide rule. In Chapter V, we find methods of computation with numbers approximately known, together with the suitability of particular methods in certain cases, carefully treated. Subsequent chapters deal with properties of functions of one angle, functions of several angles, inverse trigonometric functions, properties of oblique triangles, applications and problems, polar coordinates and complex numbers, series expansions and related topics, and (in the supplement), besides the already mentioned technique of the slide rule, the topics of graphs and logarithms.

Attention has been given to the analysis, formulation and solution of problems. These are numerous, and in their selection too much emphasis has not been placed upon special technical knowledge which the student usually and not unnaturally lacks.

Answers to the problems are supplied at the back of the book. Tables of logarithms and the trigonometric functions have been omitted. The book is well bound; the type is large and clear; there are numerous excellent graphs and diagrams. Altogether this is a well organized, adequate and satisfactory text.

A. E. STANILAND.

Return to the Secretary, F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

Society for the Promotion of Engineering Education

Date.....

THE UNDERSIGNED desiring to become a member of

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

hereby agrees to conform to the requirements of membership, if elected, and submits the following:

STATEMENT OF QUALIFICATIONS

Full Christian Name and Surname .....
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G-E *Campus News*

ALL-AMERICAN DRILL

THE guards on a football team usually take a terrible beating. Coaches often pay tribute to the courage of their guards, and marvel at their stamina. Wonder what they would say of one particular hard-headed drill that grinds and plugs away for General Electric in the fractional-horsepower-motor section of the Fort Wayne works. Here's the story:

A couple of years ago, this drill started buzzing around, drilling holes for motors and flanges. It was tipped with Carboloy, a development of General Electric research, and plenty tough. Result—it established a combination speed and durability record by completing 100,247 holes each 1 11/38 inches deep. During the years of its service, it penetrated approximately 2¼ miles of cast iron, at the rate of about 10 inches a minute, before wearing out!

SOMETHING REALLY THIN

UNTIL recently, "by the skin of your teeth" was the very peak of thinness. General Electric, however, now makes a strong bid for a new figure of speech: it is "by a weld's breadth." Engineers at the Schenectady works recently welded together strips of two alloys, Copnic and Chromel, and then rolled them to a thickness of six millionths of an inch.

The material formed by this junction has a very small heat capacity and will respond rapidly to a change in temperature.

Gold and aluminum have been beaten to similar, or even greater, thinness; but this is the first time two alloys have been reduced to such a thin section by rolling. The feat was achieved by placing the welded strips of alloy between pieces of steel and rolling the complete assembly. The product is not yet manufactured for general sale.

HARD ON THE OX

RESIDENTS of Duanesburg in Schenectady county, New York, killed and roasted their plumpest ox recently in order properly to celebrate the opening of the world's longest stretch of sodium-lighted highway. But the ox could feed only a small part of the crowd that turned out to see the sight. Shortly, at a signal picked up by an electric eye, the road glowed out clearly in the darkness. The soft, glareless light of 391 G-E sodium lights made of it a real Golden Road, 18 miles long.

Fifteen thousand people watched the celebration and listened to New York's Commissioner of Highways, Arthur W. Brandt, point out some of the savings that good highway lighting gives. They heard the figures in the case of an early lighting installation made by General Electric—a six-mile section on the well-traveled Albany-Schenectady road. Night accidents have decreased there 40 per cent. Day accidents on the other hand have increased 13 per cent.

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